

# ACRP

## SYNTHESIS 19

### AIRPORT COOPERATIVE RESEARCH PROGRAM

#### **Airport Revenue Diversification**

Sponsored by  
the Federal  
Aviation Administration



#### ***A Synthesis of Airport Practice***

TRANSPORTATION RESEARCH BOARD  
OF THE NATIONAL ACADEMIES

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## ACRP SYNTHESIS 19

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# Airport Revenue Diversification

## *A Synthesis of Airport Practice*

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Airports are vital national resources. They serve a key role in transportation of people and goods and in regional, national, and international commerce. They are where the nation's aviation system connects with other modes of transportation and where federal responsibility for managing and regulating air traffic operations intersects with the role of state and local governments that own and operate most airports. Research is necessary to solve common operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the airport industry. The Airport Cooperative Research Program (ACRP) serves as one of the principal means by which the airport industry can develop innovative near-term solutions to meet demands placed on it.

The need for ACRP was identified in *TRB Special Report 272: Airport Research Needs: Cooperative Solutions* in 2003, based on a study sponsored by the Federal Aviation Administration (FAA). The ACRP carries out applied research on problems that are shared by airport operating agencies and are not being adequately addressed by existing federal research programs. It is modeled after the successful National Cooperative Highway Research Program and Transit Cooperative Research Program. The ACRP undertakes research and other technical activities in a variety of airport subject areas, including design, construction, maintenance, operations, safety, security, policy, planning, human resources, and administration. The ACRP provides a forum where airport operators can cooperatively address common operational problems.

The ACRP was authorized in December 2003 as part of the Vision 100-Century of Aviation Reauthorization Act. The primary participants in the ACRP are (1) an independent governing board, the ACRP Oversight Committee (AOC), appointed by the Secretary of the U.S. Department of Transportation with representation from airport operating agencies, other stakeholders, and relevant industry organizations such as the Airports Council International-North America (ACI-NA), the American Association of Airport Executives (AAAE), the National Association of State Aviation Officials (NASAO), and the Air Transport Association (ATA) as vital links to the airport community; (2) the TRB as program manager and secretariat for the governing board; and (3) the FAA as program sponsor. In October 2005, the FAA executed a contract with the National Academies formally initiating the program.

The ACRP benefits from the cooperation and participation of airport professionals, air carriers, shippers, state and local government officials, equipment and service suppliers, other airport users, and research organizations. Each of these participants has different interests and responsibilities, and each is an integral part of this cooperative research effort.

Research problem statements for the ACRP are solicited periodically but may be submitted to the TRB by anyone at any time. It is the responsibility of the AOC to formulate the research program by identifying the highest priority projects and defining funding levels and expected products.

Once selected, each ACRP project is assigned to an expert panel, appointed by the TRB. Panels include experienced practitioners and research specialists; heavy emphasis is placed on including airport professionals, the intended users of the research products. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, ACRP project panels serve voluntarily without compensation.

Primary emphasis is placed on disseminating ACRP results to the intended end-users of the research: airport operating agencies, service providers, and suppliers. The ACRP produces a series of research reports for use by airport operators, local agencies, the FAA, and other interested parties, and industry associations may arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by airport-industry practitioners.

Project 11-03, Topic S01-02

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**Cover figure:** Collage—Toronto Pearson International Airport (*lower left*); International Terminal at San Francisco International Airport (*lower right and upper left*); *Courtesy: The Woodland Trust, Lincolnshire, U.K.* Cover design: Annie Kitchen, Jviation, Inc.

## FOREWORD

Airport administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to the airport industry. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire airport community, the Airport Cooperative Research Program authorized the Transportation Research Board to undertake a continuing project. This project, ACRP Project 11-03, "Synthesis of Information Related to Airport Practices," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an ACRP report series, *Synthesis of Airport Practice*.

This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

## PREFACE

*By Gail R. Staba  
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This synthesis study is intended to inform airport operators, stakeholders, and policy-makers about how airports are diversifying revenue streams. The report provides a brief discussion of different sources of revenue for airports, separating core aeronautical revenue from ancillary revenues. The report also provides a description and examples of ways that airports have diversified activities and a discussion of the challenges that arise when non-aeronautical activity is proposed on land that is subject to FAA grants obligations and assurances.

Information used in this study was developed through a review of available literature and discussions with industry experts and airport operators.

Lois S. Kramer, KRAMER aerotek inc., Boulder, Colorado, collected and synthesized the information and wrote the report. Members of the panel reviewed the original work plan and this document. The topic discussed is currently receiving extensive attention within the industry as airports strive to provide revenue consistency and self-sufficiency in an environment where both commercial aviation and general aviation is undergoing structural changes affecting the level of activity at individual airports and the financial agreements between airports and airlines, tenants, and other users. This synthesis strives to be immediately useful with the knowledge that many airport operators are evaluating new options for revenue development and diversification. The ACRP program is committed to more extensive investigation of the topic through a fully funded research effort in FY 2010.

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# AIRPORT REVENUE DIVERSIFICATION

## SUMMARY

As the airline industry consolidates and strives to achieve greater efficiencies and lower costs, airports are responding to an environment where demand for facilities and revenue streams have become less predictable. To address a higher level of risk, airports are striving to more fully utilize their land and facilities and diversify their revenue streams.

This report presents an overview of the issues surrounding development of non-aeronautical business on airport property and the techniques and mechanisms airports are using today to diversify revenue activity. Information used for this synthesis was gathered through an intensive literature review and interviews with airports and industry experts. Panel members for this project requested a broad examination of innovative ideas that would be of interest to commercial and general aviation airports of all sizes and missions. Because what is innovative for one airport may be commonplace for another, a broad spectrum of ideas is presented.

The synthesis is divided into three parts. Part 1 (chapters one and two) provides an overview of how the business model for airports has changed. Also discussed is the federal role in shaping what activities take place at an airport and how airlines, reluctant to enter into long-term use and lease agreements, have compelled airports to accept greater risk, to seek greater operational efficiencies and to diversify sources of revenue. Part 2 (chapters three and four) discusses how alternative revenue development fits within the airport planning process and reviews various strategies that airports employ to leverage their resources, form partnerships, and attract development. Part 3 (chapters five through seven) presents a number of examples of revenue diversification at airports that are fully implemented or in the initial stages of development. The examples are organized into three groups: (1) aviation services, such as ground handling; (2) non-aeronautical land development, including large-scale projects and stand-alone facilities; and (3) ancillary land uses, such as mineral extraction and renewable resources.

The following is an overview of the findings of this synthesis report:

- The business model for airports has changed. The regulatory framework for airport operations, planning, and capital projects was instituted when the airport's principal mission was to provide basic infrastructure for airlines and other aeronautical users. Today airports support a wide array of businesses, more like an industrial or commercial center, or in some cases, a small city.
- Air carrier airports, reliever airports, and general aviation airports have vastly different access to capital and the capacity to develop and maintain core facilities for aeronautical activity. That said, when it comes to revenue diversification, many reliever and general aviation airports have years of experience developing alternate sources of revenue that, out of necessity, are not passenger-dependent businesses.
- The FAA regulatory framework is focused on maintaining the safety and integrity of airports for aeronautical use. Federal definitions of aeronautical and non-aeronautical activity and financial reporting requirements on Forms 5100-126 and -127 can make it a challenge to discern the types and extent of non-aeronautical activity at an airport that is not passenger-dependent.

- Airports that have lost their status as an airline hub are often challenged to reuse or redevelop terminals for aeronautical purposes. These facilities are typically subject to FAA assurances and obligations. FAA district offices appear to handle reuse issues on a case-by-case basis.
- Extensive competition exists among airports in the United States and Canada to become intermodal logistics and distribution centers. The most successful developments take advantage of particular local market strengths, such as military base activity, cross-border commerce, and industry concentrations (e.g., aerospace manufacture, mail order, space center, research facilities, and technology).
- Although airports initiate land development projects and many invest public funds in upfront site preparation and infrastructure, the private sector plays a critical role and ultimately provides the litmus test for market feasibility. Recently, shortages of available capital have delayed many projects or required developers to renegotiate master agreements with airports to accommodate more flexible financing arrangements and project schedules.
- Airports are undertaking a number of diversification projects. Examples in this synthesis include:
  - Airport-owned and managed aviation services offered because (1) previous providers left the market, (2) the airport seeks to increase revenue, or (3) the airport is lowering station costs for airlines.
  - Energy development in the form of (1) use of airport land for solar, wind, or geothermal projects; (2) mineral extraction; or (3) research and development of biofuel feedstock and/or refining processes.
  - Non-aviation facilities that are low impact, such as golf courses, hiking trails, sports arenas, or other athletic facilities.
  - Additional passenger-dependent enterprises or services not in the terminal including valet parking, pet kennels, gas stations, convenience stores, retail outlets, and hotels.
  - Cross-utilized facilities such as health clinics that serve both employees and passengers.
  - Business and office parks, research facilities, and industrial developments.
  - Logistics centers and intermodal cargo facilities.
  - Joint development projects with military, other government entities, or private parties that involve nonmonetary exchanges to accomplish infrastructure development or to provide services such as fire fighting, utilities, and wastewater treatment.

## INTRODUCTION

### PURPOSE OF THE SYNTHESIS

Each year TRB sponsors a series of synthesis reports on current knowledge and practice in the airport industry. The intention of the synthesis is to develop a compendium of best available knowledge on addressing or resolving specific airport problems. Often, if the topic warrants further investigation, a full-scale research effort follows a synthesis project.

This synthesis was initiated because a downturn in the demand for air service, general aviation, and cargo at U.S. airports in 2008 and 2009 has had a significant and negative impact on airport finances. Most airport revenue is derived directly from aeronautical activity and services provided to passengers or other airport users. Because the scope of the downturn impacted most sectors of aviation activity, airport operators have actively pursued a combination of strategies, techniques, and incentives to retain and broaden the portfolio of businesses located at the airport.

The purpose of this study is to report on current opportunities to enhance and diversify airport revenue. Areas of particular interest include:

- Alternative land and/or facility uses
- Revenue-producing business activities
- Airport land exchanges
- Land and facility improvements
- Streamlined permitting
- Tenant services
- Renewable energy

- Incentive programs
- Rent waivers or rebates
- Military or civil joint use agreements.

The Synthesis Topic Panel also acknowledges that (1) sound management practices, (2) efforts to develop air service and to increase passenger use of an airport, and (3) development of concessions and services within the airport terminal are all vital components of cost control, revenue enhancement, and an airport's rate of return on investments. These topics are addressed in other ACRP research and syntheses efforts.

Several ACRP projects have been completed or are currently active and serve as valuable additional resources to a discussion of this topic. Table 1 summarizes relevant studies and syntheses.

### STUDY METHODOLOGY

Information used in this synthesis was collected through an extensive literature review and telephone interviews with airport operators and industry experts. Information sources included the ACI-NA e-library, AAAE, FAA, and individual airport operators. To facilitate further investigation of the topic, a bibliography, list of contacts, and consolidated list of examples are presented at the end of the synthesis.

### REPORT STRUCTURE

The synthesis is organized in three parts as shown in Figure 1.

TABLE 1  
RELEVANT ACRP STUDIES AND SYNTHESSES

Project Number	Project/Publication Title
ACRP 01-04	Marketing Techniques for Small Airports
ACRP 01-06	Guidebook for Developing an Airport Performance-Measurement System
ACRP 01-07	Airport/Airline Agreements and Rate Methodologies—Practices and Characteristics
ACRP 01-08	Guidebook on Best Management Practices for Leasing and Developing Airport Property
ACRP 01-09	Airport Performance Indicators
ACRP 01-11	Understanding Airport In-Terminal Concession Program
ACRP 01-15	Assessing and Implementing Innovative Revenue Strategies—A Guide for Airports
ACRP 03-08	Passenger Air Service Development Techniques
ACRP 03-09	Guidebook for Strategic Planning in the Airport Industry
ACRP Synthesis 1	<i>Innovative Finance and Alternative Sources of Revenue for Airports</i>
ACRP Synthesis 7	<i>Airport Economic Impact Methods and Models</i>
ACRP Synthesis Topic S03-06	Strategies for Re-use of Underutilized or Vacant Airport Facilities

Source: Assembled by KRAMER aerotek inc., from <http://www.trb.org/ACRP/ACRPPProjects.aspx> (2009).

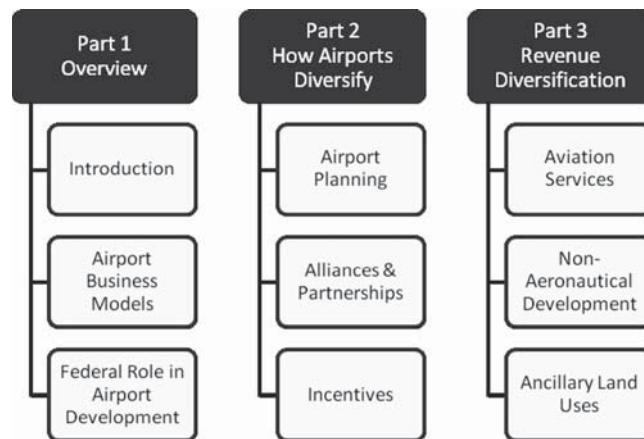


FIGURE 1 Report structure. Source: KRAMER aerotek inc. (2009).

## AIRPORT BUSINESS AND REVENUES

### TRANSFORMATION OF THE AIRPORT BUSINESS

#### Airports Before 1978

Since airline deregulation in 1978, the nature of airports has changed dramatically. Airports in the 1970s were regarded as transport infrastructure where the emphasis was on providing airlines and general aviation with the necessary facilities and services to carry out their operations. During this time, the relationship between airports, airlines, and the federal government was intertwined with a clear joint mission to provide the service and infrastructure that, in sum, became the national transportation system. In a regulated environment, aeronautical revenue was fairly predictable and not subject to market forces.

General aviation before 1978 experienced a period of rapid expansion tempered by recessions in 1960 and 1970. Business and recreational flying was fueled by a pool of veteran pilots, first from World War II, then the Korean War, and, to a lesser extent, the Vietnam War. At the time, the G.I. benefits package included tuition and flight training to obtain private pilot certification. U.S. manufacturers responded to the demand, and shipments of general aviation aircraft surged until peaking in 1978 (see Figure 2).

#### Airports After Airline Deregulation

After deregulation, the airlines moved quickly to increase service in many markets. A prolonged expansion of air service took place in the 1980s and 1990s as network carriers established extensive hub and spoke systems and low-cost carriers (LCCs) built point-to-point service, mostly in the largest markets. In the new competitive environment, airports transitioned from a business model that assumed a predictable level of aviation activity to a model where airports designated as hubs experienced rapid growth, and other airports experienced highly changeable levels of air service and air carriers. Airports quickly realized both the potential for passenger revenues and the necessity to actively engage in the recruitment and retention of airlines. The post-regulatory environment required that airports shift attention from federal regulatory proceedings to direct relationships with the airlines.

As Figure 3 shows, passenger enplanements grew rapidly from 1991 to 2000. With an increasing pool of originating and connecting passengers, airports recognized the revenue potential of passengers in the terminal. Several hub airports

responded with an extensive build-out of retail space and development of passenger services. Pittsburgh International's Midfield Terminal was one of the first airports to capitalize on this trend with the opening of its Air Mall in 1992. Retail concessions in terminals expanded rapidly in the 1990s. Since 2002 many airports have focused on upscale concession programs and premium parking services to help maximize revenue generation.

During the post-deregulation period when commercial aviation surged, general aviation activity suffered a steep decline. A number of factors contributed to this decline:

- Expansion of commercial air service attracted potential customers away from general aviation (Tarry 1995).
- General aviation demographics were changing as World War II pilots approached retirement age during the 1980s. The number of private pilots peaked at 357,500 in 1980, fell to 288,078 in 1993, and in 2007 stood at 211,096 [General Aviation Manufacturers Association (1982, 1992, 2002, 2008); *FAA Aerospace Forecasts, FY 2009–2025* (2009)].
- The oil embargoes in 1973 and 1979 drove up the price of fuel. Although these prices appear low in comparison with today's prices, higher fuel prices added to the cost of general aviation flying (see Figure 4).
- The cost to purchase general aviation aircraft was also rising. During the 1970s and 1980s general aviation manufacturers experienced a large number of liability lawsuits and increased liability insurance premiums. As a consequence, Cessna withdrew from the single engine aircraft market, Beech reduced production levels, and the Piper Aircraft Corporation filed for Chapter 11 bankruptcy. It was not until 1994 that the U.S. Congress passed the General Aviation Revitalization Act limiting aircraft manufacturer liability exposure.

This combination of events caused the single engine aircraft sector to languish. General aviation aircraft manufacturers focused on larger, more costly, and sophisticated business aircraft. For those general aviation airports that served corporate aviation activity levels remained stable or prospered, whereas many of the smallest general aviation airports have faced declining demand for recreational flying.

In summary, for the period following deregulation, most commercial service airports experienced expansion of aero-

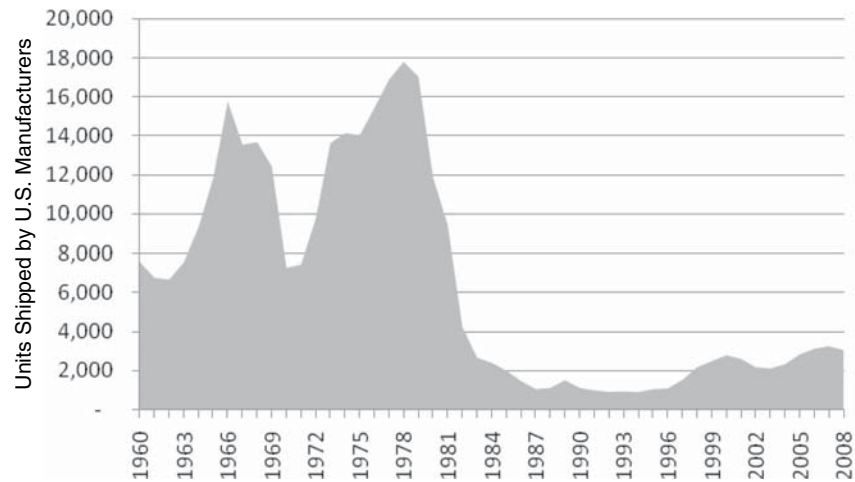


FIGURE 2 General aviation aircraft shipped by U.S. manufacturers. *Source:* General Aviation Manufacturers Association.

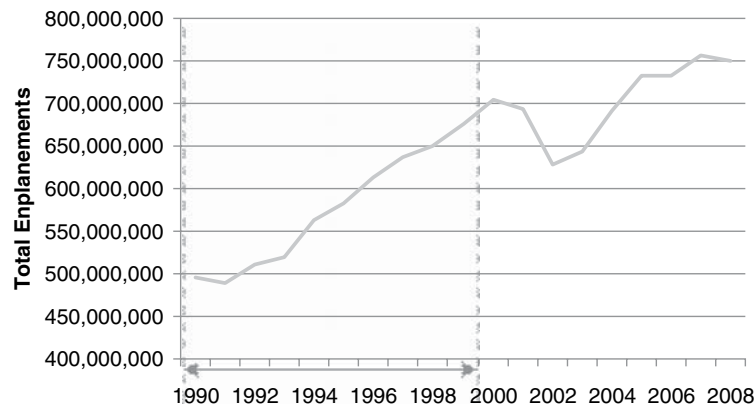


FIGURE 3 Total enplanements at U.S. airports, 1990–2008. *Source:* FAA, Terminal Area Forecasts.

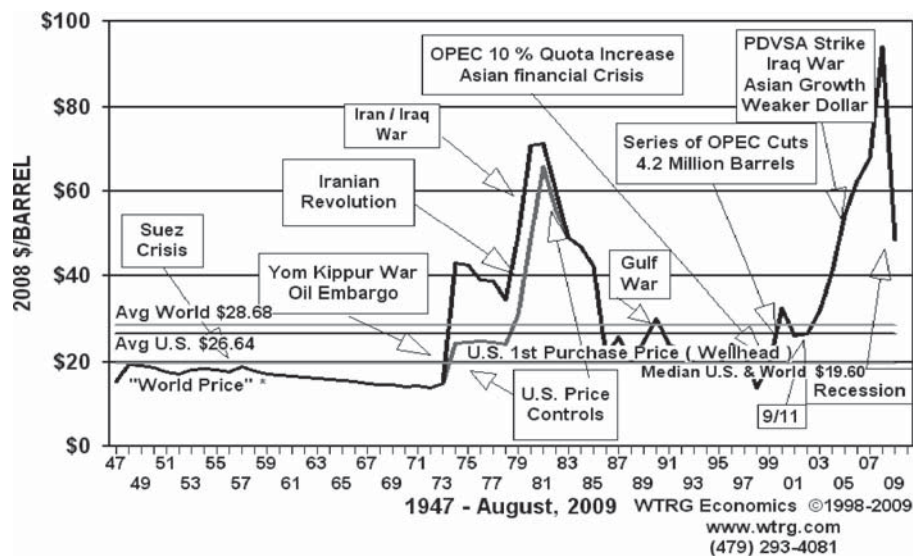


FIGURE 4 Cost of crude oil: 2008 dollars. *Source:* WTRG Economics at [www.wtrg.com](http://www.wtrg.com).

nautical revenue and passenger-dependent revenue. Many general aviation airports, facing declines in operations, based aircraft and fuel sales, redoubled recruitment efforts, and looked for new business to supplement operating revenues.

### **New Economy for Commercial Service Airports**

Fast forward to today and while the basic roles for the airlines, airports, and the FAA remain intact, for a variety of reasons, the business of capitalizing and operating a commercial service airport has become far more complex:

- Airline bankruptcies, restructurings, and downsizing have resulted in greater vacancy risk in terminals.
- LCCs typically have higher utilization of aircraft and require fewer gates and terminal space to process passengers.
- Because airlines are grappling with unpredictable fuel costs and diminished passenger demand, all possible cost reductions are in play, including airport costs. This is affecting airline–airport use agreements, rates and charges, and capital projects at airports.
- The trend is toward shorter-term airport–airline use agreements. Airport operators are assuming more of the financial risk of running the airport. Today, use agreements typically incorporate a combination of residual and compensatory cost recovery. With a residual cost approach, airlines collectively agree to pay the costs of running the airport that are not allocated to other users or covered by all other sources of revenue. With a compensatory approach airports set rates and charges to recover the costs of facilities and services that airlines use.
- Airlines are also shifting from exclusive use gates, where there is a fixed lease rate for a set period of time, to preferential or common use gates, where airlines pay on a per-turn basis. Common use or preferential use gates can lower airline station costs; however, from the airport’s perspective, they can also result in reduced revenue when the number of flights decline.
- Historically, airports have synchronized leases with an asset’s lifetime (20 to 30 years). Bonds were rated based on expected revenue streams. With lease terms shortening and perceived increased airline risk, airports are challenged to maintain the ability to raise capital and to keep borrowing costs low (Stettler 2009).

In response to changes in the air carrier industry, airports are applying a variety of strategies to reduce expenditures, postpone capital projects, increase staff and facility productivity, and diversify revenues with more non-airline businesses.

The airport business model is in transition. Figure 5 summarizes how airports started as support facilities and infrastructure for airlines (1970s). In the 1980s and 1990s, airports expanded operations into a wide variety of passenger-dependent

concessions including retail stores, restaurants, and customer services. The current model for commercial service airports transforms the airport into a portfolio of businesses that provide diversified and replacement revenue streams.

### **FEDERAL ROLE IN SHAPING THE BUSINESS OF AIRPORTS**

Federal grants, policy, and regulations have defined the domestic system of airports and shaped the activities and development that takes place on airport property. This section briefly summarizes the influence of the federal government on airports, beginning with funding sources for capital projects, revenue diversification, grant assurances and obligations, and federal compliance reporting on airport revenues and expenses.

#### **Definitions of Aeronautical and Non-aeronautical Activity**

The federal system of airports defines core aeronautical activities at an airport as those activities that take place on the airfield or in the terminal where airlines operate. Other passenger-dependent activities such as food and beverage, retail concessions, parking, and rental cars are considered non-aeronautical. Non-aeronautical activity is a broad category encompassing the passenger-dependent activities, as well as rent on land and non-terminal facilities and fees collected for activities and services on airport property (*FAA Airport Compliance Manual* 2009).

When an airport receives Airport Improvement Program (AIP) funds and enplanes more than 2,500 in a calendar year, the FAA requires commercial service airports to file annual financial reports (Form 5100-127). This report has become the de facto method of, in financial terms, describing airport revenue centers. Figure 6 groups various airport revenue activities according to broad accounting categories established by the FAA: aeronautical and non-aeronautical. For purposes of this synthesis, non-aeronautical has been subdivided into passenger-dependent activities and ancillary development to more clearly identify and separate out economic activity that contributes to airport operating revenue, but is not necessarily dependent on commercial air service or passengers.

#### **Funding Sources for Capital Projects**

Federal grants through the AIP have played a central role in building commercial service and general aviation airports and in defining what activities take place on airports. For the smallest hub airports, AIP grants can fund almost 60% of capital projects; for large and medium hubs, AIP funding is proportionally much smaller, and passenger facility charges much greater. A full discussion of funding sources is available in *ACRP Synthesis 1: Innovative Finance and Alternative Sources of Revenue for Airports* (Nichol 2007).

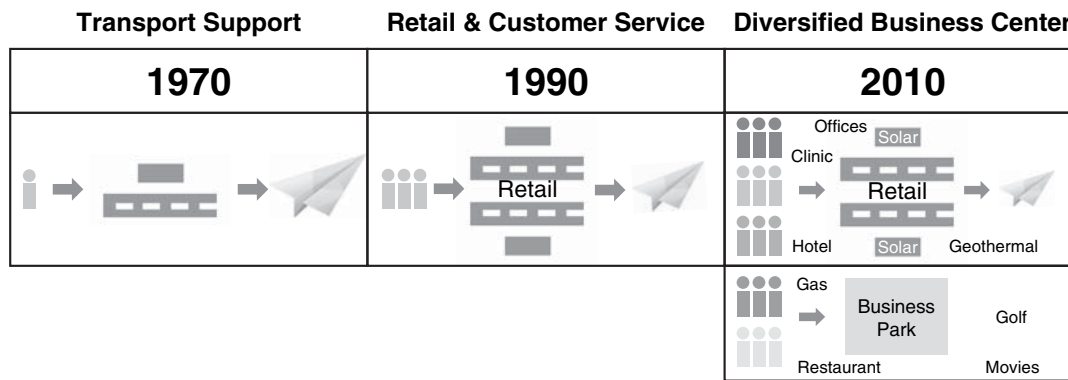


FIGURE 5 Transformation of the airport business. Adapted by KRAMER aerotek inc., from Robert Hazel, Oliver Wyman, Inc. (2009).

ACI-NA estimates that between 2009 and 2013 airports in the United States will incur \$94.3 billion in capital development costs, based on a sample of 100 commercial service airports. Figure 7 shows anticipated funding sources for capital projects at airports of all sizes. Almost one-half of all funding sources for capital development are subject to federal policy. This would include passenger facility charges, customer facility charges, TSA grants for security, and AIP funding. Typically for smaller airports the percentage is higher. For larger airports, revenue bonds account for another 30% and state and local funds the remaining 20%.

#### Funding Sources for Operations

Although federal funds and passenger facility charges contribute heavily to capital projects, as Figure 8 shows operations and maintenance at the largest airports are funded by airport users. For smaller commercial and general aviation airports this is not usually possible and, consequently, federal, state, and local funds contribute to both construction and maintenance of airport facilities. Project eligibility is subject to total cost, fund availability, project priorities, and local match requirements.

#### Grant Assurances

Accepting federal grants requires an airport sponsor to comply with certain obligations and assurances. These obligations and assurances become binding contracts between the airport sponsor and the U.S. government. The obligations define uses of airport revenue, environmental compliance, and public use and access. Chief among these obligations are the following as described in the 2009 *FAA Airport Compliance Manual*:

- Prohibition on exclusive rights
- Utilization of airport revenues and land for aeronautical purposes
- Implementation of a fee and rental structure that makes the airport as financially self-sustaining as possible under the particular circumstances at that airport
- Proper maintenance and operation of airport facilities
- Protection of approaches
- Compatible land use
- Adherence to the approved Airport Layout Plan (ALP)
- Sale, lease, or disposal of federally acquired property for non-aeronautical purposes that return fair market value and are subject to FAA approval

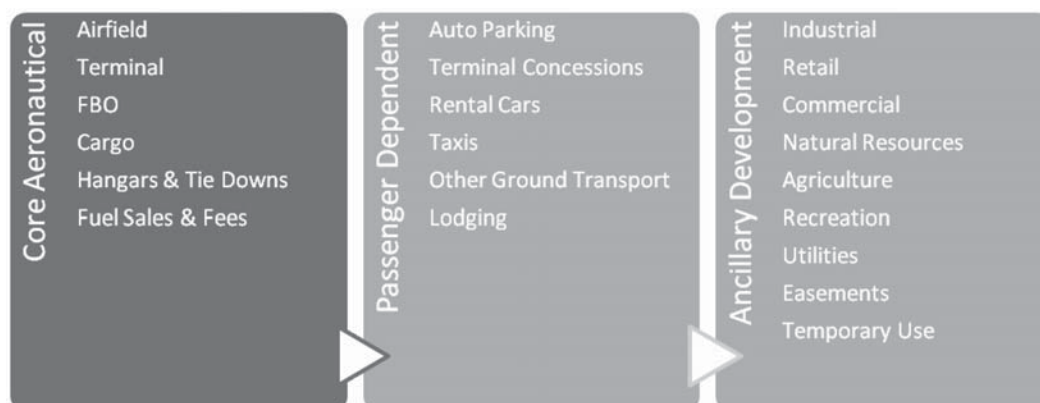


FIGURE 6 Airport revenue centers. Source: KRAMER aerotek inc. (2009).

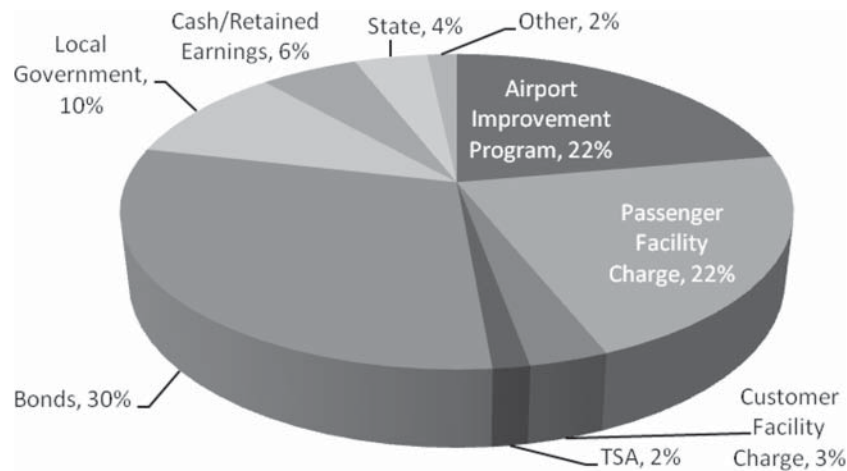


FIGURE 7 Funding sources for anticipated capital airport projects, 2009–2013. ACI–NA Survey of Airport Capital Development Costs (Feb. 2009).

- Preservation of rights and powers
- Availability of fair and reasonable terms without unjust discrimination
- Retention of clear title on airport property
- Maintenance of acceptable accounting and recordkeeping systems
- Compliance with civil rights and disadvantaged business enterprise requirements.

Grant assurances are intended to reserve airports as air transportation facilities and to preserve the federal investment at individual airports and collectively in the national system of airports. Airport sponsors must agree to grant assurances if they accept federal grants or surplus property. None of the assurances prohibit either land development or use of airport revenue for non-aeronautical purposes, but they do guide and establish certain limitations.

#### *Restrictions on Land Development*

Many airports acquire land with federal grants for future development, wetland protection, or noise mitigation. Grant assurances provide the following guidance concerning the sale or disposition of land acquired with federal funds (in part or in entirety).

- Land acquired with federal funds can be disposed of at fair market value with FAA approval.
- Proceeds from a sale of land need to be returned to the Airport and Airway Trust Fund or reinvested in another approved AIP project in proportion to the share of federal dollars used to fund the original project.
- It is important that land acquired with federal funds for runway protection zones or noise buffer land remain reserved for aeronautical use. Revenue from alternative

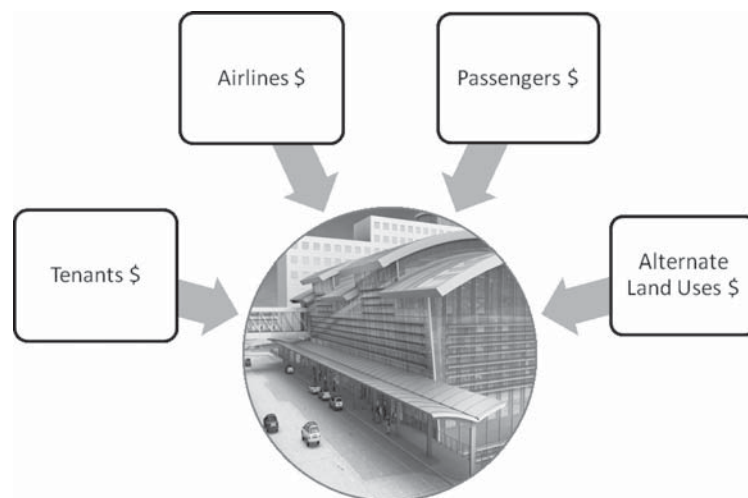


FIGURE 8 User pay concept for airport operations. *Source:* Adapted by KRAMER aerotek inc., from SH&E (2009).

(and compatible) uses of the land must contribute back to the financial self-sufficiency of the airport.

- If land in a noise buffer zone is sold, it needs to contain deed restrictions specifying that future development be compatible with noise levels associated with airport operations.
- When there is a change contemplated in the status of land acquired with federal assistance, it is important that airports discuss plans with their Program Manager at the FAA Airports District Office.
- Changes in the status of land acquired with federal grants need to be reflected in the ALP and Master Plan.

### *Restrictions on Revenue*

In 1999, the FAA promulgated policy concerning rate structures and the use of airport revenue to make an airport self-sustaining. Allowable uses of airport revenue to develop airport land that serves a direct aviation purpose are clear. Restrictions on the use of airport revenue to develop land not used for aviation purposes are less clear and in practice appear to be handled on a case-by-case basis (Nichol 2007).

### *Implications of Limitations for Non-Aeronautical Development*

As the aviation industry matures in the United States, and if the domestic industry continues to consolidate and shrink, limitations on land development and restrictions on the use of airport revenue may yet become a significant issue for airport self-sufficiency. For example, individual airports experiencing facility vacancies are increasingly challenged to remain self-sufficient and fully utilized for aeronautical activity. Lambert–St. Louis International Airport has large sections of three concourses that are no longer used for commercial air service. Cincinnati/Northern Kentucky International Airport

is also experiencing a loss of connecting traffic (and facility utilization) as Delta transitions this facility into a regional hub. The Allegheny County Airport Authority (Pittsburgh International Airport) has closed Concourse E and outlying gates on Concourse A and Concourse B. The Authority is consolidating commercial service activities and aggressively pursuing other economic development. Although airport de-hubbing has caused extreme issues of facility utilization, other smaller-scale instances of facility redevelopment for non-aeronautical purposes are occurring at many airports.

### **Financial Reporting**

Except on an individual airport-by-airport basis, it is difficult to obtain a consolidated view about how airports are diversifying their businesses to include non-aeronautical activity that is not passenger-dependent. The FAA requires commercial service airports to file annual financial reports when an airport receives AIP funds (and signs grant assurances). FAA Form 5100-127 has become the de facto method of, in financial terms, describing airport revenue centers. Roughly half of airport operating revenues come directly from aeronautical activity. This would include landing fees, terminal rentals, apron charges, fixed-based operator (FBO) revenue, cargo and hangar rentals, fuel flowage fees, fuel taxes retained by the airport, and reimbursements for security. However, dependence on airline activity for revenues is actually much greater than an accounting of aeronautical revenues. There are many “passenger-dependent” revenues that are counted as non-aeronautical revenue, including auto parking, food and beverages, retail, and rental car fees.

### *Sources of Commercial Airport Revenue*

Figure 9 shows total aeronautical and non-aeronautical revenue reported by commercial airports in 2008. Operating revenues are summed by airport size (large, medium, small, and non-hub)

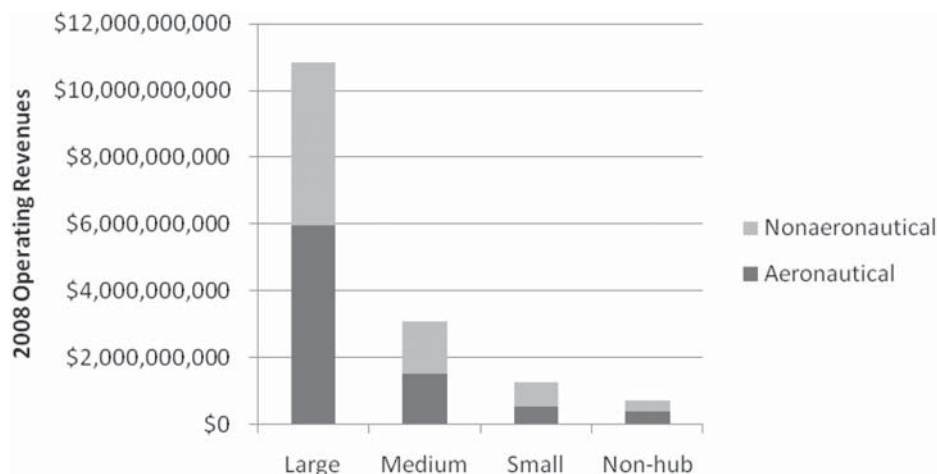


FIGURE 9 Commercial service airport operating revenues, 2008. *Source:* FAA, AAS-400: CATS: Report 127.

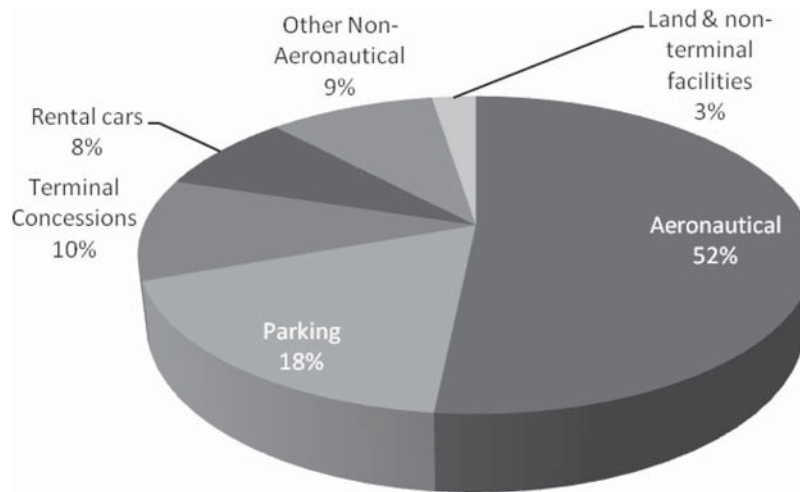


FIGURE 10 Airport operating revenue by source for large and medium U.S. hub airports, 2008. *Source:* FAA, AAS-400: CATS: Report 127.

airports). There are 30 large hub airports, 38 medium hubs, 68 small hubs, and 385 non-hub airports. Large hub airports generate 68% of aeronautical and non-aeronautical revenue; medium hubs, 19%; small hubs, 8%; and non-hubs, 4%. General aviation airports receiving federal grants are not required to file Form 5100-127 and thus there is far less information about operating revenues at general aviation airports.

Although reports filed by commercial airports provide extensive and detailed information about airline and passenger-dependent revenue, much less detail is available about operating revenue earned from “non-airline” sources. This would include rents received for use of airport property such as manufacturing, warehousing, hotels, offices, retail, or other ancillary land uses. Figure 10 shows aggregate revenues for large

and medium U.S. hub airports. Aeronautical and passenger-dependent non-aeronautical revenues represented 88% of total airport operating revenue in 2008.

Figure 11 shows airport operating revenues by source for small and non-hub airports. Small and non-hub airports derive less of their revenue from airline and passenger-dependent activities. Rent from airport properties and non-aeronautical fees and services represent 14% of total revenue.

The aggregate view does not adequately represent the great strides some individual airports have made to diversify revenue. For example, Indianapolis International Airport, privately managed from 1995 to 2007 by BAA Airports Limited, is more diversified than most medium hub airports. In 2008, rent for land and non-terminal facilities and other

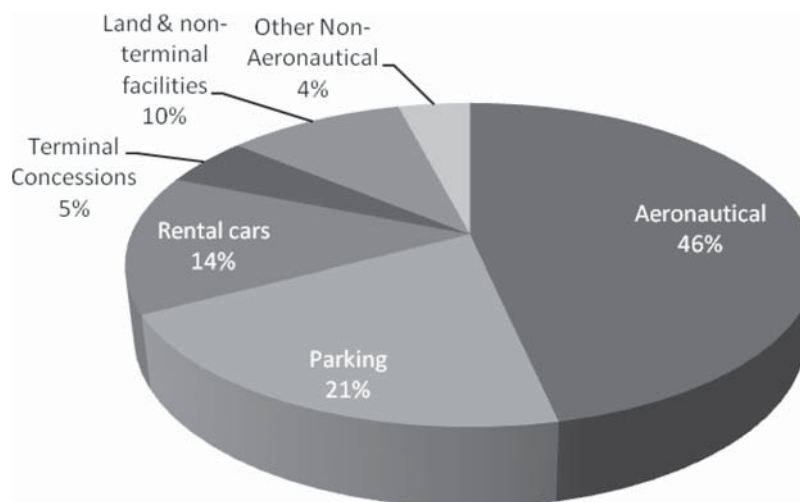


FIGURE 11 Airport operating revenue by source for small and non-hub airports, 2008. *Source:* FAA, AAS-400: CATS: Report 127.

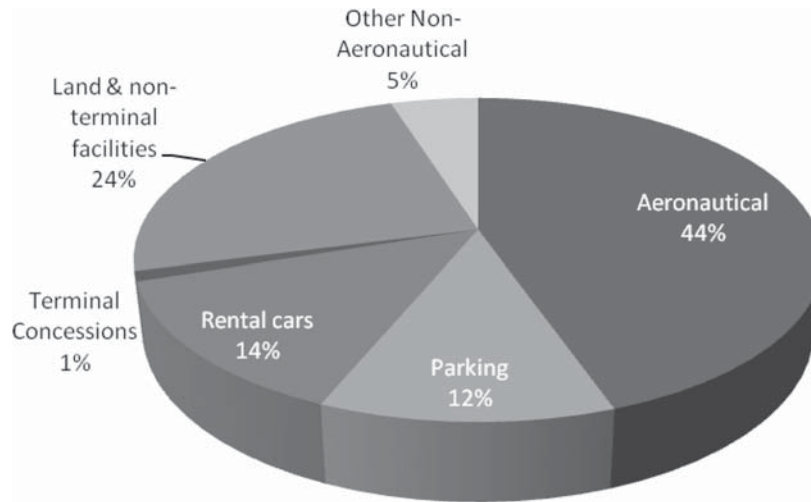


FIGURE 12 Airport operating revenue by source for Mobile Regional Airport, 2008.  
Source: FAA, AAS-400: CATS: Report 127.

non-airline revenue represented 20% of total operating revenue. The airport historically and today maintains an active development program. Indianapolis is home to the second largest Federal Express operation in the world. The airport redeveloped a 1.6 million square-foot maintenance facility that United Airlines abandoned in 2003. Because no single tenant wanted the entire facility, the airport subdivided the complex and leased out space to a variety of tenants.

Mobile Regional Airport (whose tagline is “more than just an airport”) offers another example of an airport with a diverse revenue portfolio. For this non-hub airport, rent on land and

non-terminal facilities, plus other non-aeronautical revenue that is independent of passengers, represents 29% of total operating revenue (see Figure 12).

#### Trends

In the last ten years, total airport operating revenues have been growing. Figure 13 compares 1998 with 2008 operating revenues in nominal dollars (no adjustment for inflation) for large, medium, small, and non-hub commercial service airports. Total operating revenues grew 79% in that ten-year

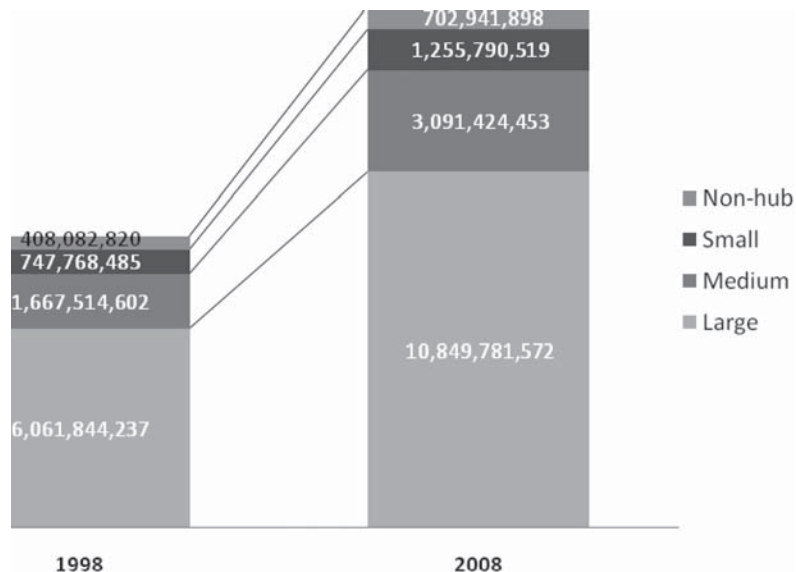


FIGURE 13 Total airport operating revenues by hub size, 1998 and 2008.  
Source: FAA, AAS-400: CATS: Report 127.

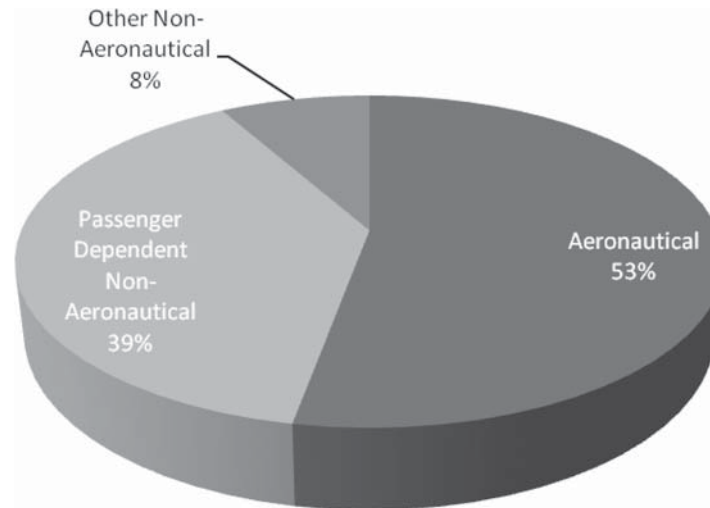


FIGURE 14 Operating revenue contributions, Commercial Service Airports, 2008. *Source:* FAA, AAS-400: CATS: Report 127.

period, from \$8.9 billion to \$15.9 billion. Relative shares of operating revenues have remained fairly constant, with large hub airports reporting 68% of operating revenue; medium hubs, 19%; small hubs, 8%; and non-hubs, 4%. At this highly aggregated level, the share of operating revenue that is non-aeronautical actually declined slightly from 50% in 1998 to 47% in 2008.

A closer evaluation of non-aeronautical operating revenues suggests that almost all non-aeronautical revenues at airports are passenger-dependent and include terminal concessions, parking, and rental cars. Figure 14 illustrates the relative contributions of aeronautical revenue, passenger-dependent non-aeronautical operating revenues, and other non-aeronautical operating revenues that include rent on land and other non-

terminal facilities. Passenger-dependent non-aeronautical revenues represented 39% of total operating revenues in 2008; other non-aeronautical, 8%. However, since 1998 several trends are apparent:

- Passenger-dependent non-aeronautical revenues grew the most at medium hubs (90%) and at small hubs (81%). Large hub airports and non-hubs grew by 67% and 66%, respectively (see Figure 15).
- Large and non-hub airports experienced greater non-aeronautical revenue growth that was not passenger-dependent. Between 1998 and 2008 operating revenues derived from rent of land and non-terminal facilities grew by 58% at large hubs, 54% at non-hubs, 24% at medium hubs, and 43% at small hubs (see Figure 16).

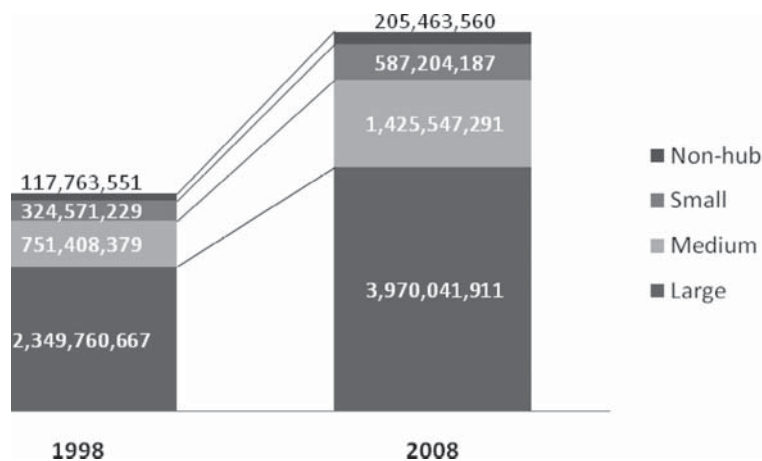


FIGURE 15 Passenger-dependent non-aeronautical revenue, 1998 and 2008. *Source:* FAA, AAS-400: CATS: Report 127.

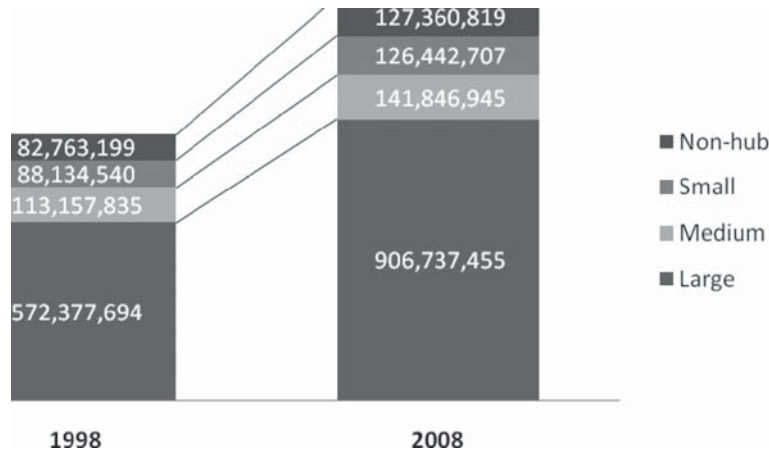


FIGURE 16 Rent on land and non-terminal facilities, 1998 and 2008.  
Source: FAA, AAS-400: CATS: Report 127.

### NECESSITY AND OPPORTUNITY FOR REVENUE DIVERSIFICATION

The global recession, volatile fuel prices, and tight credit markets challenged airlines in 2008 and 2009 in distinct ways:

- The recession has slashed demand for air travel and air cargo, especially in business and premium sectors;
- The credit crisis has made cash reserves more important to airline survival. Higher borrowing costs have lead airlines to focus on operational strategies to conserve cash (Meehan 2009);
- Volatility in fuel costs means that airlines are not likely to add back capacity without strong evidence of a sustained recovery; and
- LCCs are now a dominant player in U.S. cities offering 29% of nonstop seats in U.S. markets, mostly in the largest markets (*Official Airline Guide* Aug. 2009). The LCCs have achieved a market position that can set or heavily influence price.

These factors and the reality that nearly 80% of all domestic air travel takes place to and from the 15 largest U.S. metropolitan cities (Hollander 2008) suggests that airports face a higher risk as well. Airlines will be less willing and able than in the past to contribute to capital projects, operations, and

maintenance costs at airports. Recent changes in aircraft size, frequency of service, and abandonment of routes all serve as reminders that the essence of airline operations involves moveable assets.

Where a long-term plan for an airline is 3 to 5 years, for an airport it is 10 to 20 years. Airports are required to look beyond current problems and address substantial capital needs and commitments. The cost of capital within the industry accounts for 30% of airport revenues (Schimm 2009). Forward-looking airports are thus focused on what is possible in terms of creating new revenue streams and maximizing existing sources of revenue.

To begin thinking about revenue diversification requires examination of non-airline revenue streams in an organized fashion. Figure 17 sets forth a structure of non-aeronautical business units. On the left side in the first two columns are interterminal concessions and passenger services. The focus in this synthesis is on aviation services, non-airline tenants, and ancillary land use (columns 3–5). Part 2 of this report addresses how airports incorporate revenue diversification in their planning processes and implement the strategies through partnerships, private contracts, and incentive packages, and Part 3 presents a wide range of revenue diversification ideas that have been tried at commercial service and general aviation airports.

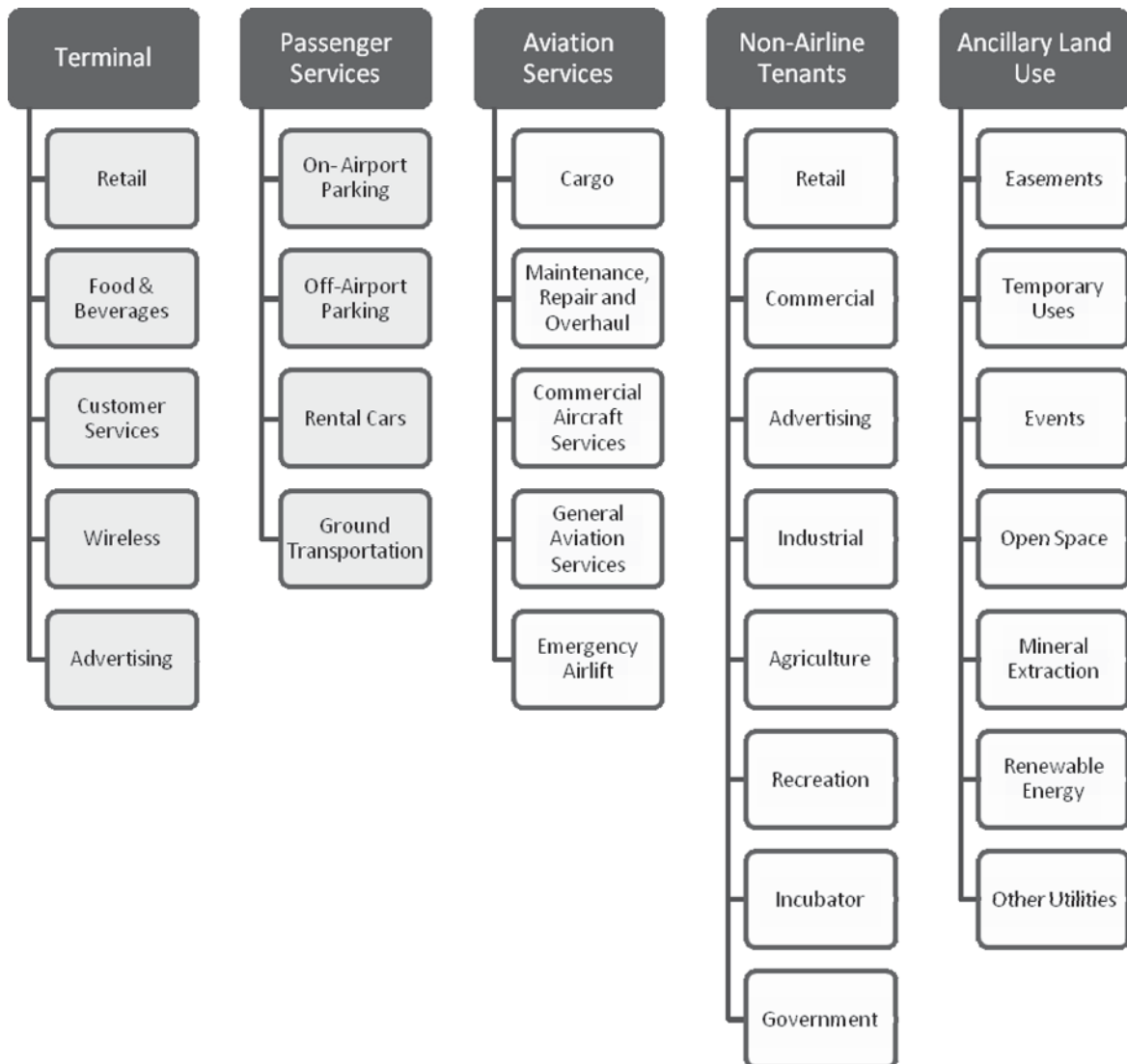


FIGURE 17 Non-aeronautical business units. *Source:* Adapted by KRAMER aerotek inc., from SH&E (2009).

## PLANNING ISSUES

The synthesis thus far has described how the airport business model has evolved and the regulatory and accounting context for aeronautical and non-aeronautical activity at airports. Part 2 (chapters three and four) examines how airports integrate revenue diversification strategies into the planning process (this chapter) and reports on various incentives and partnerships airports use to accomplish non-aeronautical development (chapter four).

### AIRPORT PLANNING PROCESS

To receive federal and state funding, airports are required to have an ALP that consists of a narrative and a graphic presentation to scale of existing and planned airport facilities, their location on the airport, and the pertinent clearance and dimensional information required to show compliance with applicable standards. The narrative of an ALP provides a history of the airport, forecasts of aviation activity, an assessment of facility requirements, a justification for future capital projects, and an analysis of any environmental impacts and plans for mitigation.

Every public airport in the National Plan of Integrated Airport Systems (NPIAS) has at least an ALP and many airports have master plans. The master plan process amplifies the ALP in that its main function is to focus on facilities and future needs. The master plan considers the airport role, vision, and possibilities, and examines various alternative configurations for airport land in a 25-year time frame. Master plans would include land that can be used for non-aeronautical purposes; however, the real focus is on aviation facilities.

Today, because airports are now complex businesses, the master plan has become part of a larger planning framework where many airports have a strategic plan as well as a master plan, business plan, and marketing plan. But it is the strategic planning process that formulates the vision and direction for the airport (see Figure 18).

The strategic plan sets forth the foundation for airport initiatives and defines the roadmap that the airport could follow to achieve its vision and goals. All other planning initiatives should be aligned with the strategic plan (Ricondo & Associates 2009). Figure 19 places the strategic plan in the context of other typical airport planning activities. Each of these plans would include an action plan that defines near-term objectives, activities, resources, and staff requirements to implement, communicate, monitor, and evaluate progress.

### PLANNING FOR NON-AERONAUTICAL DEVELOPMENT

Non-aeronautical development requires attention to a planning process that parallels the planning framework that is typical for aeronautical facilities. Revenue diversification would be incorporated into the strategic plan, and options and risks considered. Development plans would be included in the master plan and specific near-term action items would be carried out in the business and marketing plans. In more concrete terms a non-aeronautical development would include the following steps:

1. Articulate the vision, short- and long-term goals for revenue diversification consistent with the airport's vision.
2. Complete a SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats)
  - a. Evaluate the airport's assets—traditional and non-traditional
    - i. Land, location, market for goods and services
    - ii. Natural resources
    - iii. Non-aviation assets (corporate headquarters, hospital, university, training facilities).
  - b. Understand realistically the customer base for the airport's assets
    - i. Passengers
    - ii. Employees
    - iii. Community
    - iv. Research and development
    - v. Cargo and logistics
    - vi. Other location-sensitive businesses
    - vii. Our airport is attractive because. . .
  - c. Know constraints and limitations on non-aeronautical development
    - i. Grant assurances and obligations
    - ii. Other legal, physical, and environmental constraints on property development
    - iii. Infrastructure and site preparation costs.
  - d. Consider the competition
    - i. Other airports in the region
    - ii. Local retail centers, industrial or business parks
    - iii. Parcels of land available for development close to the airport
    - iv. Airports outside the region seeking similar "movable assets and businesses."
3. Evaluate development options
  - a. Land use plan
  - b. Civil engineering analysis

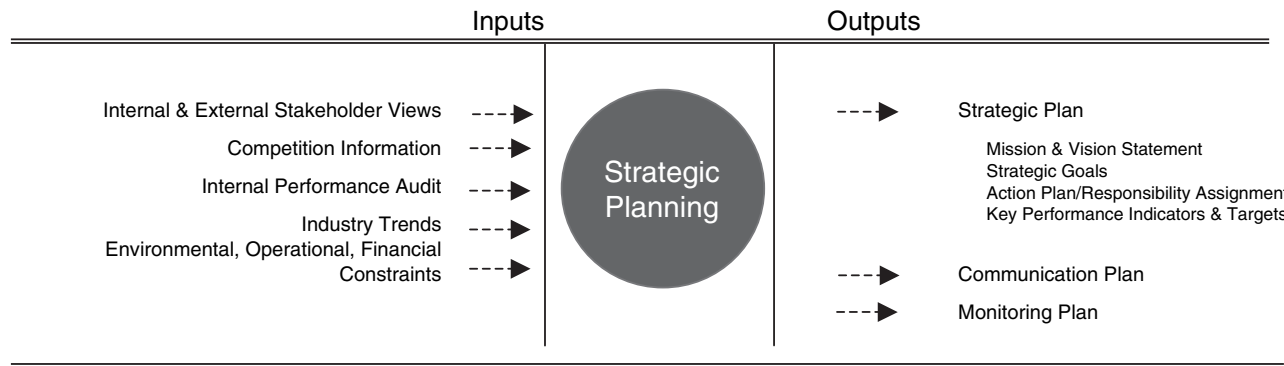


FIGURE 18 Strategic planning process. Adapted by KRAMER aerotek inc., from Ricondo & Associates, Inc. (2009).

- c. Demand analysis
- d. Real estate market analysis
- e. Estimate of capital expenditures
- f. Identification of highest and best uses for available parcels
- g. Potential stakeholders
- h. Constraints and obstacles
- i. Potential projects and partners
- j. Timeline
- k. Cost/benefit and economic impact.
4. Prepare a business plan (short- to medium-term action plan)
  - a. Set measurable objectives
  - b. Department-level action plan that guides day-to-day implementation
  - c. Marketing and public relations plan when appropriate.
5. Execute the business/action plan.
6. Monitor, evaluate, improve.

This approach to non-aeronautical activity can be integrated into an all airport land planning effort or completed separately.



FIGURE 19 Airport planning process. Adapted by KRAMER aerotek inc., from Ricondo & Associates, Inc. (2008).

The following example of planning for revenue diversification was accomplished by Dayton International Airport.

#### DAYTON INTERNATIONAL AIRPORT STRATEGIC BUSINESS PLAN

Dayton has a long aviation history beginning with the Wright brothers and the first manned flight flown from Dayton in 1905. Fascination with powered flight led several businessmen, including E.G. Beichler, President of Frigidaire; Frederick B. Patterson, President of National Cash Register; and Charles F. Kettering, Vice President of General Motors and President of the General Motors Research Group, to invest approximately \$187,300 to build a private airport on 311 acres north of Dayton. The airport opened at the end of July 1929 and went into receivership during the Great Depression. In 1934, the city of Dayton leased the airport and in 1936, the local business community raised \$65,000 to purchase the airport, which it subsequently turned over to the city for one dollar.

Dayton's storied history continues. During World War II the airport became an army training field. The army acquired various parcels of land around the airport and constructed a heavy duty parallel runway. In 1947, the Federal War Assets Administrator deeded "Dayton Army Airfield," containing more than 551 acres of property and related military facilities, to the city of Dayton and extinguished its lease of the airport (<http://www.flydayton.com/index.php?page=history>).

Today, Dayton International Airport (DAY) is considerably larger, spanning 4,500 acres, and has three paved runways (see Figure 20). In the 1980s, Emery Worldwide built a cargo hub at Dayton, which it continued to expand until the early 1990s. Piedmont Airlines operated a passenger hub at DAY for three years starting in 1986, until USAir acquired Piedmont in 1989. USAir and its successor company US Airways discontinued long-haul routes out of Dayton, but continued to operate DAY as a Midwest focus city. Today, Air Tran Airways and Frontier Airlines provide low-cost service



FIGURE 20 Dayton International Airport airfield layout. *Source:* Dayton International Airport (2009).

at Dayton. The airport is also served by Air Canada, American, Continental, Delta, Midwest, United, and US Airways. Competitive fares at Dayton attract passengers from the Cincinnati/Lexington area.

Dayton has a number of unoccupied cargo and industrial buildings designated for aeronautical use and many undeveloped acres. In 2008, the airport completed a Strategic Business Plan to serve as a framework for future business decisions. The plan presents a mission-vision-values statement, and long-and short-term goals for five strategic areas: operational excellence, customer service, business development, regional partnerships, and air service. Figure 21 shows Dayton's mission, vision and values statement and Figure 22 is an example of how Dayton framed its strategic initiatives for revenue diversification and development of non-airline businesses. In August 2008, Dayton began a comprehensive study of development options to determine the highest and best use of 650 acres on the airport designated for both aviation and non-aviation uses. The study has brought together various disciplines including land use planning, civil engineering, socioeconomic analysis, environmental assessment, project finance, and real estate market research to identify the highest and best uses of the proposed areas, identify constraints and obstacles that could hinder the development process, and define the development options.

#### ***Our Mission***

*We contribute to the prosperity of Southwest Ohio by connecting it to the rest of the world through our aviation system.*

#### ***Our Vision***

*Our airport facilities are the gateways of choice for travelers, airlines, and entrepreneurs in Southwest Ohio.*

#### ***Our Values***

*Public Service  
Continuous Improvement  
Excellence  
Results*

FIGURE 21 Mission, vision, and values for Dayton International Airport. *Source:* Dayton International Airport, *Strategic Business Plan* (2008).

***Business Plan:  
View of Our Flight Plan into the Future***

**Strategic Initiative: *Business Development***

***Strategy***

To maximize non-airline revenues by optimizing utilization of airport assets and aggressively expand alliances with new business partners.

***Short-range goals***

- Construct a 3-level parking garage as part of the five-year \$110 million airport capital improvement plan.
- Expand rental car ready-return facilities by adding 250 rental vehicle spaces.
- Facilitate development and construction of a nationally branded hotel on airport grounds.
- Expand on-airport surface parking by approximately 1,000 spaces.
- Obtain Federal Aviation (FAA) acceptance of a "Master Plan" and FAA approval of an "Airport Layout Plan" (ALP) and "Exhibit A" property map for Dayton International Airport, which collectively chart the Dayton International Airport's course for the next 20 years.
- Complete a business development database for the revitalized airport website that lists available Airport sites and buildings, infrastructure, regional supply chain, and available business incentives.
- Release approximately 400 acres of Airport property for non-aeronautical uses and complete a comprehensive land-use study that will define the "highest and best use" for the property.

***Long-range goals***

- Lease 400 acres to bring new business to enhance airport revenues and job growth in the Greater Dayton Region.
- Lease 1.2 million square feet (former UPS facility) for cargo or aviation-related business.
- Connect the airport to adjacent rail line to make it an inter-modal facility.

***Measurable outcomes***

- Increase total annual airport revenues.
- Raise non-airline revenue as a percentage of total annual revenue.
- Increase annual cargo landed weight.
- Increase total annual concession revenue per enplaned passenger leased space.
- Increase net annual parking revenue per enplaned passenger.

FIGURE 22 Dayton International Airport sample of strategic initiatives. *Source:* Dayton International Airport (2008).

## LEADERSHIP, PARTNERS, ALLIANCES, AND INCENTIVES

Most non-aeronautical development programs at airports involve multiple parties, alliances, and partnerships. The subject area is vast and innovative examples exist at many airports. There is also much to learn from other transportation modes and community development projects. Recent problems in the banking industry and the economic recession have added uncertainty to many projects, extended timetables, and introduced unexpected fluidity of investors and partners. Strong airport leadership and partners, a well-defined market or customer base, and an incentive package have become a critical foundation to attract and retain developers, tenants, and airlines. This chapter will highlight some of the methods airports use to accomplish development projects.

### IMPORTANCE OF AIRPORT LEADERSHIP

A thorough planning process described in the previous chapter will help to identify revenue diversification opportunities that make sense within the region and markets that an airport serves. However, there are also intangible attributes of the airport and community leadership that contribute to the success of a project. They include:

- **Airport stewardship that aligns airport interests with the long-term goals of the community.** This would include airport projects that support the region's economic goals. The project benefits may be greater to the community in terms of jobs, tax base, and spending than direct revenue to the airport. Typically, large inter-modal projects, commercial, office, and industrial parks offer economic benefits that go well beyond the airport. Military projects also fall into this category as they are high community impact, but do not always generate substantial revenue for the airport per se. Utility projects such as wastewater treatment (Front Range Airport, Colorado) or mosquito control facilities (Savannah Hilton Head Airport, Georgia) also offer significant community benefits, as do aviation museums that serve as tourist destinations. Airport stewardship positions the airport within the community and region, well beyond the airport boundaries and remains one of the most effective long-term methods to build alliances and to resolve airport–community issues.
- **A healthy respect for the airport's areas of competence and boundaries of that competence.** Airports are governed by federal, state, and local regulations that determine what activities are permissible. However, level

of airport engagement in a permissible activity is typically left to airport management and sponsors. For example, some airports provide ground handling services to airlines; others subcontract services to third parties and/or the airlines take care of ground handling on their own. Participation in airport development projects also varies widely from ground leases only; to infrastructure development; or actual construction, leasing, and management of buildings and facilities. Some airports can take entrepreneurial positions in private enterprises; others are prohibited by state or local law. Understanding the limits of airport competence, staff resources, and ability to take on risk are extremely important when an airport contemplates revenue diversification projects.

- **Knowledge of each party's interest in a particular project.** Project partners bring to the table shared goals and different capabilities. Airports can offer land as well as access to facilities and customers. These can be monetized and traded. For example, the Colorado Springs Municipal Airport has worked with its counterparts in the city's Open Space Department to arrange a land exchange that consolidated airport parcels for development. The airport also entered into an agreement with an airport tenant that established a net present market value for a parcel of land and exchanged "the value of the ground lease" for needed access roads on the airport that the tenant in turn would construct. When capital for airport improvements is in high demand or short supply, the art of negotiation and exchange can advance a particular project when airport management has a clear strategy of what is to be accomplished, its own assets, and the particular interests and objectives of involved public and private parties.
- **Constant networking.** A recent survey of airport managers conducted in connection with *ACRP Report 28, Marketing Guidebook* (Kramer et al. 2010) found networking to be one of the most effective (and inexpensive) ways to effectively stay in touch with business leaders, community groups, news media, public officials, airlines, tenants and prospective tenants, developers, and industry groups. Networking builds alliances and important relationships over time.
- **Attention to details and the money.** Because most revenue diversification projects engage multiple parties and require share responsibilities it is important to be clear about agreement details, capital contributions, and project management responsibilities.

- **Airport staff that function effectively together.** A truism, but enormously important, is that motivated airport staff that cooperates well and functions effectively is indispensable.

Good airport leadership and an effective airport organization can make all the difference in an airport's fortunes. It is of course an advantage if the airport has access to capital and a solid market or markets to serve. However, these alone are not always enough without good leadership.

## **ALLIANCES AND PARTNERSHIPS**

Today, most airport projects are accomplished by consortiums of private and public groups. Partnerships and alliances form to share resources (time, money, and people) and to accomplish tasks of common interest. Alliances and partnerships can also bring together different skill sets, complementary experience, and networks, and improve the odds for a successful outcome. This section describes some of the most common airport alliances and partnerships.

### **Shared Resources and Facilities**

#### *Multi-Modal*

Airports are active participants in multi-modal projects that connect the airport to other modes of transport: rail, road, bus, and sea. For example, the Miami Intermodal Center (MIC) involved every mode of transportation and their respective governing agencies, the regional planning groups, and many private developers and contractors (see chapter six for more detail on this project). Other recent multi-modal projects completed, under study, or in design include:

- Denver International Airport—FasTracks station and airport train.
- Harrisburg International Airport—Multi-modal transportation facility.
- Port Authority of Allegheny County Airport (Pittsburgh)—Multi-modal corridor study.
- San Diego Association of Governments (SANDAG)—Airport Multimodal Accessibility Plan.

#### *Equipment, Facilities, and Staff*

Airports also enter into partnerships or alliances to develop and/or to share use of equipment, staff, and facilities. Many of these partnerships occur at smaller airports and result in cost reductions for the airport. Typical partnerships involve joint use agreements between the airport and other branches of local government or the military. Joint use may include:

- Aircraft, rescue, and fire fighting staff and equipment;
- Snow plows and heavy equipment;
- Air traffic control towers; and

- Utilities including power, water, and sewer; renewable energy installations; and fiber optic.

### *Infrastructure Development*

Development projects often require (1) rights-of-way and easements, (2) land exchanges, and (3) construction of access roads. Infrastructure development on or adjacent to airport property carried out by private developers or other government groups provides an airport with the opportunity to offer rights-of-way or easements in exchange or for revenue, to consolidate land parcels, and to extend access roads to areas of airport development. With strategic and land use plans in place, airport management can maximize these opportunities.

### **Military Joint Use**

There are several instances in the United States where airports share facilities with military bases: Colorado Springs and Peterson Air Force Base, Ft. Walton Beach and Eglin Air Force Base, and Westover Air Reserve Base/Metropolitan Airport. These airports provide examples of shared air traffic control, utilities and road development, joint use of aircraft rescue and fire fighting equipment and facilities, and agreements on security and defense access. Joint use facilities can have an enormous positive impact on the infrastructure of an airport.

### **Public Alliances**

Alliances evolve over time. In 1995, the cities of Chicago and Gary created the Chicago/Gary Regional Airport Authority to coordinate airport development in the region. The Authority came about because there were competing plans to redevelop Chicago O'Hare Airport and to build a new third airport at Peotone, Illinois. This joint Airport Authority is now in its fifteenth year, and the third airport possibility has long been resolved. More recently, the city of Chicago contributed \$10 million to Gary to revitalize the Gary/Chicago Airport. The FAA contributed \$8 million and the city of Gary \$20 million. In this example, the alliance between competitors helped diffuse a prolonged (and expensive) discussion about a third Chicago airport and over time led to productive joint development efforts (Infanger 2003).

### **Public–Private Partnerships**

Public–private partnerships accomplish both development projects and research. Fort Worth Alliance Airport is a city-owned public-use facility located 14 miles (23 km) north of the central business district of Fort Worth, Texas. The airport was developed in a joint venture between the city of Fort Worth, FAA, and Hillwood Development Company, a real estate development company owned by H. Ross Perot, Jr. The airport opened in December 1989. It is owned by the city of Fort Worth and managed by Alliance Air Services, a sub-

sidiary of Hillwood. Today, Alliance serves as a cargo hub for Federal Express and is a maintenance base of American Airlines.

Daytona Beach International Airport is participating in a partnership between the airport, Embry–Riddle Aeronautical University, and Lockheed Martin. The Integrated Airport Project, funded through a \$1.96 million FAA grant, will evaluate new technologies to better predict airport weather conditions and to improve ground surface management of runways and taxiways. Daytona Beach International is the test site (Richards 2008).

### Marketing Alliances

When it comes to marketing, alliances among stakeholders will prove invaluable. Both commercial and general aviation airports form marketing alliances with local chambers of commerce and economic development agencies. This can be an effective way to pull together a marketing program that is low cost and capable of reaching a wide audience.

### Partnership Roles for Commercial and Industrial Property

Airports apply three basic strategies for airport development:

1. In the *lowest risk* strategy, the airport offers a long-term ground lease to a developer. For industrial or warehouse projects, the developer brings a “build-to-suit” subtenant, leases the land from the airport, and constructs the building. For mixed-use office and retail, the airport role is similar, but the developer may build on speculation that the space will be subleased. The airport will collect on the ground lease and usually the lease contains provisions to collect some percentage of gross revenues. Often, at the end of the lease, all developed property reverts to airport ownership.
2. With the *highest risk* approach, the airport is the developer and carries the total cost of the project. The airport is also responsible for finding a tenant and managing the property. The highest risk approach offers the potential to reap the greatest returns.
3. The third strategy is a *joint venture* approach, where the airport and one or more partners develop a parcel. It is common in these instances that the airport will complete some or all of the site preparation and other partners will do the rest. Joint ventures require complex agreements, coordination, and oversight. Most of the large multi-use developments described in Part 3 of this document are structured as joint ventures. To gauge the complexity of a joint venture, Figure 23 shows how Dallas/Ft. Worth International Airport coordinates in-house the roles and responsibilities for a joint venture commercial development.

## INCENTIVES

### Overview of Incentives

The U.S. Economic Development Administration defines incentives as “. . . any inducements state and local governments use to attract and retain companies and facilities.” Incentives are designed to meet a variety of business needs such as access to capital, site preparation and infrastructure, permitting and regulatory approvals, job training, and reduced start-up and operation costs. Governments have become more sophisticated and now offer incentives to achieve specific targeted objectives. Performance-based requirements have been used with air service consultants and lately with the airlines themselves.

Incentive packages are usually offered to prospective airlines or developers, although it is important that care be exercised to abide by FAA regulations concerning competition. The most common types of incentives are described in Table 2. Every state and local government has its own rules and regulations regarding what is offered, requirements, qualifications, disclosure, and enforcement.

Most airports or airport authorities know what incentives are offered at the federal, state, and local levels. The creativity starts with the structure of the partnership, the division of responsibilities, cost, and risk. The incentives sweeten the deal and smooth the regulatory process. Performance-based incentives quicken the pace and encourage achievement of objectives. Some airports, including Oakland International Airport, use performance-based incentives to enhance parking revenue generation.

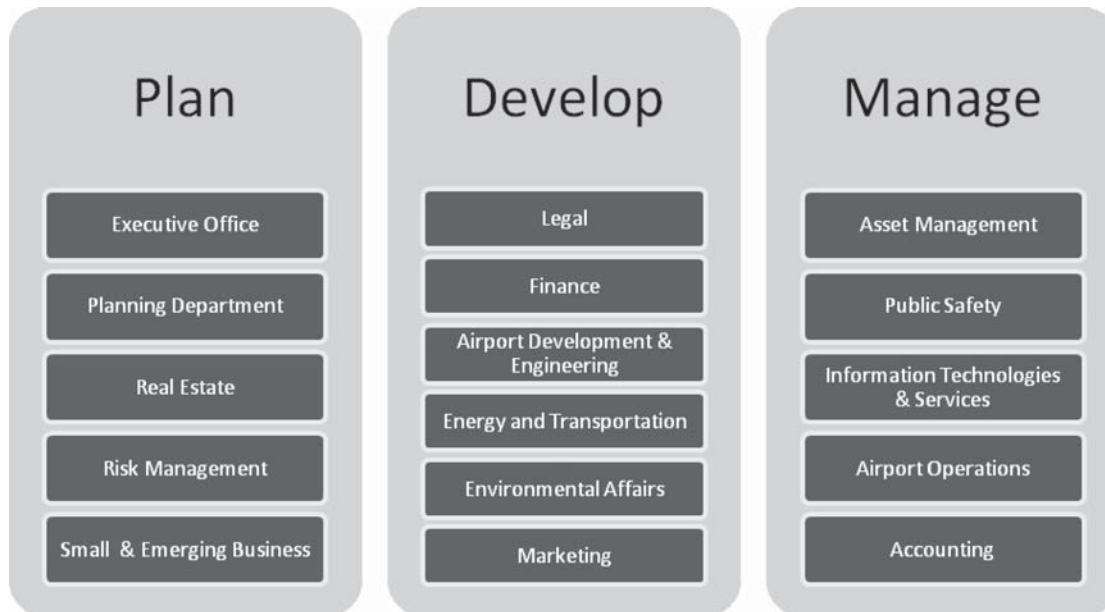
To fully cover the use and efficacy of incentives invites another synthesis or full ACRP project. However, there are interesting new additions to the palette of airline incentives discussed in the next section.

### Airline Incentives

Airports have experience with the use of incentives to attract and keep airlines. What is changing is emphasis. Early incentive programs were directed at reducing the risk of market entry. Revenue guarantees and travel banks were initially attractive. It would be fair to say that at this point in time most airlines are not interested in market risk and have abandoned unprofitable or marginal markets. Airports also have grown tired of expended revenue guarantees and subsequent service loss.

With a focus on station costs, recent incentive programs target reductions in carrier operating costs at the airport. They include:

- Landing fee reductions/eliminations,
- Reduced rental rates,



- 
- Executive Office – Vision, mission, values, project coordination
  - Planning Department – Land use planning
  - Real Estate – Market analysis, rates and charges
  - Risk Management – Regulatory requirements, insurance, loss control and prevention, Enterprise Risk
  - Small and Emerging Business – Identify Disadvantaged Business Enterprise (DBE) resources and assist with implementation
  - Legal – Counsel support and lease review
  - Finance – Secure capital improvement financing
  - Airport Development and Engineering – Engineering and construction services
  - Energy and Transportation – Provide sustainability support
  - Environmental Affairs – Environmental compliance
  - Marketing – Joint marketing of property
  - Asset Management – Maintenance and sustainability of infrastructure systems
  - Public Safety – Emergency planning and response
  - ITS - Information technologies and services
  - Airport Operations – Protect airfield interests and operations
  - Accounting – Payables and receivables
- 

FIGURE 23 Commercial development coordination, roles, and responsibilities at DFW. Adapted by KRAMER aerotek inc., from Brookby (2009).

TABLE 2  
BASIC TYPES OF INCENTIVES USED AS TOOLS TO FACILITATE DEVELOPMENT

Incentives	Description
Finance	
Bond	Debt financing instrument to finance infrastructure.
Grant	Direct cash subsidy from a government entity. Grants are typically for a specific project.
Revenue bonds (IRBs)	Tax-free bonds that are repaid from the revenue generated by the facility.
Revolving loan	Loan amount that can be withdrawn, repaid, and redrawn again until the arrangement expires.
Tax increment financing	A real estate redevelopment technique that allows a company to finance land acquisitions or improvements by borrowing money tax free (thus reducing interest rates) and lets companies purchase renovated sites or buildings at below-market costs.
Tax Abatement	
Property tax	Local government exempts company from paying some or all of the property tax over a fixed time period.
Sales tax	Local and state government exempts company from paying some or all of the sales tax over a fixed time period.
Income/franchise tax credits	State tax credits allowed when companies initiate specific types of activities (varies by state).
Approval Process	
Fast track permits	System to provide expedited review and permit decisions.
Permit fee reductions	Reductions in permit fees for certain types of projects.
Employment	
Job training	Offered for creation of a certain number or type of jobs associated with a new project.
Payroll tax credits	Local or state payroll tax credits given for initial job creation.
Cost Reductions	
Site preparation	Site preparation and/or infrastructure completed by the sponsoring entity.
Fee and rental reductions	Temporary reductions in landing fees or reduced rents.
Pricing	Selective discounting to promote use per FAA grant assurances and obligations.
Utility rebates/subsidies	Subsidies, credits, or rebates for utilities.
Ground handling	Provision of ground handling services above and/or below the wing.
Facility improvements	Public expenditures to improve facility for new tenant.
Risk Reduction	
Revenue guarantees	Funds set aside to guarantee that an airline receives an agreed amount of revenue for usually a new service or increased frequency of service.
Airport marketing	Marketing paid for by airports to increase airport awareness and passenger use of local air service.
Performance-Based Credits	
On time	Credits for on-time delivery of project.
Passenger growth	Credits for increases in passengers.
Revenue growth	Credits for increased gross revenues.

Source: KRAMER aerotek inc. (2009).

- Provision of ground handling services, and
- Facility improvements.

Airports are also offering revenue sharing for expanded service and an increased number of passengers. Most of the

revenue sharing comes back to the carrier as a credit to station expenses (Meehan 2005). Marketing remains a sought after incentive by the airlines, although most airlines require compliance with their advertising specifications, logos, and other marketing collateral.

## AVIATION SERVICES

Aviation services support commercial and general aviation activity and are among the most traditional types of development found at airports. Figure 24 shows major groupings of aviation services: cargo; maintenance, repair, and overhaul (MRO); ground handling; and general aviation. From a revenue generating perspective, airports participate in a variety of capacities as a landlord, real estate developer, as joint partners, and as actual operators. Many small general aviation airports traditionally own some or all of the hangars at an airport and often serve as the FBO. A number of commercial service airports have taken on ground handling services.

The focus of this chapter is aviation services and includes examples of airports that are providing ground handling services to airlines and that have successfully redeveloped underutilized or abandoned facilities. A list of airports contacted or studied is presented at the end of the synthesis.

### GROUND HANDLING SERVICES

#### Overview of Ground Services

Ground handling addresses the many services required when an aircraft lands and arrives at a terminal and when it departs. Airlines focus on turnaround time, so speed, accuracy, and efficiency are critical in ground handling services. Ground services involve activity in the terminal, on the ramp, and in the aircraft as follows:

- Ramp services—supervision, marshalling, moving/towing aircraft, and safety checks;
- On-ramp aircraft services—fueling, wheel and tire check, ground power supply, deicing, cooling and heating, water and lavatory service, maintenance, and cleaning exterior of aircraft;
- On-board services—cleaning, catering, in-flight entertainment, and minor servicing of cabin and seats;
- Operation of ramp equipment—passenger steps or jet bridges, catering loaders, cargo and baggage loaders, tow bars, push-back tractors, forklifts, and ground power units; and
- In-terminal passenger services—check-in counters, gate arrival and departure services, staffing customer service stations, and lounges.

Airlines typically handle ground services themselves or they contract with a handling agent or another airline.

Airports have also taken on ground handling services for a variety of reasons because: (1) an FBO exited the market and the airport stepped in to provide fuel and ground handling; (2) the airport offered ground handling as an incentive for an airline to enter or stay in the market; or (3) the airport expanded its services to include ground handling as a way to increase airport revenue.

#### Examples of Airport-Operated Ground Services

Table 3 lists examples of airports that directly offer ground services. These six airports have operated as ground service agents or FBOs for some time and are summarized briefly here. There are other commercial service airports that manage ground services through contracts with third-party vendors and many general aviation airports that fuel aircraft and function as the FBO.

The AAAE in recognition that many small and medium airports provide ground services have established an affiliate organization, the Aviation Ground Services Association (AGSA). The mission statement of the organization is:

... to protect rights and options of airport operators regarding the provision of ground service operations through the airport operator, qualified FBOs, airport/airline service companies, or through joint ventures formed by the airport operator, airlines and the ground service industry. AGSA also promotes standardization of ground service tasks to enhance operational efficiencies and cost-effectiveness, while enhancing customer service to the airlines and the flying public. (AAAE website: [http://www.aaae.org/about\\_aaa/aaae\\_committees/agsa/](http://www.aaae.org/about_aaa/aaae_committees/agsa/).)

#### *Bangor International Airport*

Bangor International Airport was originally Dow Air Force Base. In 1967 it was decommissioned and the city of Bangor took over the facility and began the process of converting the military facility into a public airport. Original plans did not call for the city to operate the FBO; however, in 1972 the existing FBO, TransEast Air went into bankruptcy, so the airport took over operation of the FBO. The municipality has operated the FBO since 1972 and offers a full complement of services for large commercial and general aviation aircraft. Today, a staff of approximately 50 full-time, part-time, and on-call employees is available for passenger handling, baggage loading and unloading, fueling, water and lavatory service, aircraft cleaning, coordination of catering, aircraft de-icing,

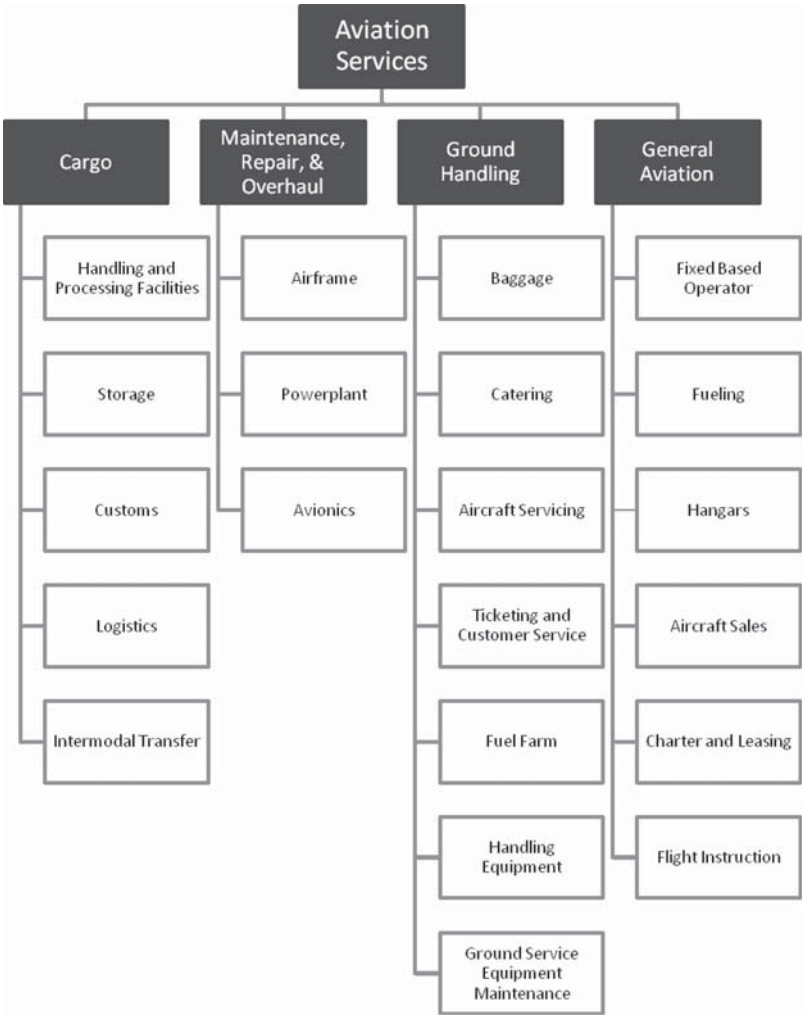


FIGURE 24 Overview of aviation services. *Source:* KRAMER aerotek inc. (2009).

light maintenance, and flight planning. Historically, Bangor International handled many international technical stops and offered U.S. Customs service to charters, military aircraft, and diverted flights. The airport was recently selected as a diversion airport for Emirates Airlines A380 aircraft. (Bangor has an 11,440 ft runway.)

For more than 30 years the municipality partnered with ExxonMobil Aviation primarily for fuel, training, marketing, and advertising. However, changes in Maine corporate tax laws resulted in an ExxonMobil decision to not operate in Maine. Bangor is now supplied by Irving Oil and Western Petroleum.

TABLE 3  
EXAMPLES OF AIRPORTS OFFERING GROUND SERVICES

Airport	City/State	Airport Size	Management	Objective
Bangor International	Bangor, ME	Non Hub	Division of Airport	Replaced FBO
Front Range	Watkins, CO	General Aviation	Airport Authority	Revenue Center
Lehigh Valley International	Allentown, PA	Small Hub	Airport Authority	Replaced FBO
Mobile Regional	Mobile, AL	Non Hub	Airport Authority	Airline Incentive/Non-Profit
Quad City International	Moline, IL	Small Hub	LLC	Replaced FBO/Now Revenue Center
Springfield–Branson National	Springfield, MO	Non Hub	Division of Airport	Incentive and Revenue Center

*Source:* Compiled by KRAMER aerotek, inc. (2009).

The positives for an airport-owned and operated FBO are (Kipler 2008):

- Increases airport's marketability
- Strengthens relationships with airlines
- Provides an alternate source of revenue for the airport
- Reduces costs of entry and operations for the airlines
- Offers airlines control over the level of service needed
- Provides ground handling staff experienced with many different aircraft
- Provides opportunities to attract international flights with Federal Inspection Services.

The challenges of operating a municipal ground handling operation include:

- Regulatory compliance (FAA, Customs and Border Protection, and TSA)
- Environmental compliance issues (e.g., deicing and secondary containment for fuel trucks)
- Public health concerns (e.g., aircraft drinking water and international trash)
- Fuel quality assurance
- Competitive pricing
- Operating expense
- Union issues.

#### *Front Range Airport*

Front Range Airport is located approximately six miles due east of Denver International Airport. The airport opened in 1984, making it one of Colorado's newest general aviation airports. Since its inception, the airport has owned and operated the FBO selling fuel for based aircraft (392) and visiting aircraft. In addition to fuel, the FBO offers rental service and courtesy cars, shuttles to Denver International Airport and nearby hotels, catering, the Aviator Café, flight and weather planning, crew lounge, heated hangars, and meeting rooms. Major engine and airframe repair service is available at the airport, but operated privately. Land on the 3,989 acre airport is available for private development of hangars and other industries.

#### *Lehigh Valley International Airport*

Lehigh Valley International Airport (Allentown, Pennsylvania), Queen City Airport (Allentown, Pennsylvania), and Braden Airpark (Easton, Pennsylvania) are all owned and operated by the Lehigh-Northampton Airport Authority. The authority also owns and operates the Lehigh Valley Aviation Services, which functions as the FBO and handles corporate and general aviation at each of the airports. At Lehigh Valley International, Aviation Services fuels commercial aircraft and also currently provides ground support for Allegiant Air, Air Tran, and Direct Air. These services are mostly ramp services and in-terminal ticketing and passenger services. There is a small amount of cabin cleaning, but no catering. Aviation

Services has provided ground handling for other smaller commercial airlines in the past.

#### *Mobile Regional Airport*

Mobile (Alabama) Regional Airport's Station Management Services was started in October 2001 as part of the airport authority's strategy to retain US Airways service to Charlotte and to use ground services as an incentive to attract other airlines. The business model is designed to lower station costs for an airline. The Mobile Airport Authority owns and operates the business, charging an airline on a per-turn (one arrival and subsequent departure) basis for equipment and staff.

The original start-up costs for the airport's ground services were funded in part by a grant from the Small Community Air Service Development Program and a contribution from the city of Mobile. The initial funding was spent to acquire ground handling and office equipment (\$145,000) and an additional \$312,000 funded direct operating expenses for the first year of operation (personal, supplies, and maintenance). The ground handling operations have continued. US Airways continues to serve Charlotte with three daily departures (as of September 2009) and use the airport's Station Management Services. In April 2005, American Eagle agreed to provide two daily frequencies to Dallas/Ft. Worth using Mobile's ground services. That service has since increased to four frequencies. Airport officials believe that savings on ground handling costs contributed to American's start-up decision (U.S. General Accountability Office 2005).

Mobile's Station Management Services are priced to break even. The airport reports that its ground services reduce start-up costs by two-thirds and operating costs by 30%.

#### *Quad City International Airport*

Quad City International Airport (QCIA) (Moline, Illinois) is a small hub airport with air service to Atlanta, Orlando, Chicago O'Hare, Denver, Detroit, Memphis, and Minneapolis/St. Paul. Air Tran, Delta, American Eagle, and United Express provide the service. The airport is operated by the Metropolitan Airport Authority of Rock Island County, Illinois, and governed by a Board of Commissioners.

QCIA Airport Services is a Limited Liability Corporation (LLC) that was formed to provide fueling services at the airport when the fuel vendor ceased operations in November 2003. The LLC functions as a subsidiary of the Authority. The Authority provided \$600,000 for start-up costs.

QCIA Airport Services (QCIA-AS) has grown organically. It began by taking over the fueling operation and purchasing two refueling trucks from the previous vendor (which it has since replaced). QCIA-AS operates the fuel farm. Air carriers purchase their own fuel and store it at the farm. QCIA-AS

charges a per-gallon fueling fee and a hook-up fee. They also maintain an inventory of fuel to sell at retail rates. Elliot Aviation, a corporate and general aviation FBO located on the other side of the airfield, has its own fuel farm as does John Deere and Lee Enterprises. By gentleman's agreement QCIA-AS sells only to charters and air carriers.

In addition, QCIA-AS provides ground handling for charter carriers. Comair staff handles ground services for United Express and Delta Connection flights. American Eagle also has its own station staff. QCIA-AS maintains a fleet of ground handling equipment to provide above- and below-wing services. Ground handling is offered on a per-turn basis, with base fees for ramp and ticket counter support and an a la carte schedule of services from which an airline can choose.

Ground handling personnel for charters are part-time airline employees who work in coordination with their existing airline schedules. This works well to ensure that all staff are properly trained and have the requisite experience. The fuel farm is staffed by one manager, five full-time employees, and one part-time employee. In FY 2007, QCIA-AS pumped 5.4 million gallons of fuel, provided approximately 11,000 hook-ups, and had net income of \$172,612 after expenses (Carter 2008).

The biggest addition to Quad Cities' ground handling operations began in May 2009. At that time, Air Tran was considering leaving the market. The Airport Authority developed an incentive program to keep the airline. The largest portion of the package included QCIA-AS taking over ground handling duties for the Air Tran station. Air Tran employees were offered ground handling positions and the airport purchased Air Tran equipment. Today, 17 Aviation Services employees, including a manager, handle Air Tran ground operations. QCIA-AS provided services first on a 4 month pilot program and has signed an 18 month contract to continue; however, Air Tran has made no service guarantees. The rates established by the airport authority to provide ground services are on a cost recovery basis, as are other airport rates and charges such as landing fees. Cost recovery includes both operating and capital costs.

#### *Springfield-Branson National Airport*

In 2002, Springfield-Branson National Airport began its ground handling service, starting with charter aircraft. There were between 80 and 100 charters annually and the airport acquired surplus vehicles and equipment to provide ground handling. That same year, the airport expanded to provide boarding pass screening for all the airlines. In 2004, the airport expanded screening to a new addition of the terminal and began below the wing ground handling for Comair. In 2005, Allegiant entered the market and the airport handled above and below the wing for Allegiant. Current ground handling includes charters, four daily flights for ASA (below the wing), and 13 weekly flights for Allegiant (above and below the wing). The airport also holds the deicing contract for Delta.

Pricing for ground services is similar to other airports on a per-turn basis, with an array of a la carte fees to provide Air Start, a ground power unit, cabin cleaning, lavatory and potable water service, and deicing. The Springfield-Branson Airport sees the ground servicing business unit as a way to generate profit for the airport. In FY 2009, this unit generated \$765,000 in operating revenue.

Airport administration offered a few suggestions for success (Schroeder 2008):

- Hire the best management team possible.
- Start out slow . . . more opportunities will come.
- Don't buy new ground equipment, but be prepared to have mechanics on site to maintain what you buy.
- Organize training programs that support growth. Each airline requires staff to go through approved FAA programs. Utilize 'Train the Trainer' classes to train agents and new hires locally.
- Keep performance levels high; good prices get contracts, but ultimately performance matters.

#### *JFK Terminal 4*

Most airport-operated ground handling services take place at small- and medium-size airports. JFK Terminal 4 offers a different paradigm. Terminal 4 is the only non-airline privately operated terminal in the country formed as a joint venture between the Port Authority of New York and New Jersey and the JFK International Air Terminal LLC, a private consortium originally combining the resources of Schiphol USA, an affiliate of the Amsterdam Airport Schiphol; LCOR Inc., a national real estate developer; and Lehman Brothers, an investment bank. The management company oversees the entire operation while aircraft are on the ground. This includes control over what and how many ground handlers will perform operations. The goal is to offer competitive ground handling without predatory pricing. As of 2008, five ground handling companies provide services: Aircraft Service International Group; Evergreen International Aviation, Inc.; Swissport International LTD; and Triangle Aviation Services. Northwest Airlines also provided ground handling at the time (Reinhardt 2008).

#### *Observations and Further Investigation*

There is considerable experience both in Europe and the United States in the area of airport-owned ground handling services, common use equipment and services, and airport-managed third-party contracts. In the United States, airport-owned and operated ground services are well-established businesses at small- and medium-size commercial service airports and many general aviation airports. The examples provided in this synthesis share a few common features:

- Airlines that provide limited frequency schedules are good candidates to contract out ground handling services to another airline, the airport, or a third-party vendor.

- Allegiant Air, Air Tran, and Direct Air appear to use other airlines or airport-operated ground services with some frequency.
- US Airways, Delta Connection, and American Eagle have also used airport ground services on a limited basis.
- There are a number of situations that cause an airport to begin offering ground services. The two most common involve: (1) the departure or bankruptcy of an existing FBO or (2) the airport agrees to acquire an airline's ground handling equipment and offer employment contracts to airline personnel to retain the carrier's air service at the airport.
- Airport-operated ground services tend to benefit most airlines that are new to the airport and have not yet set up a station or hired employees. Cost savings also can go to the first incumbent airline if the airport purchases its ground handling equipment and facilities. Once the service is established, incumbent airlines have less potential cost savings as station equipment and staff are already in place.

Because airports offer ground services for different reasons, further investigation of this topic could take into account an airport's objectives for providing the service. Airports embrace different philosophies about pricing the services; some airports set fees to recover costs, others offer services as part of an incentive package to air carriers, and some airports operate their ground services as a revenue center.

Airport accounting practice also varies. Ground services may not be tracked as a separate business unit. Sometimes ground services are integrated into various airport operations; for example, fueling, deicing, or passenger services might be tracked in different accounts. In these instances it is difficult to discern whether the airport is covering costs or making money on these services.

Larger airports in the United States and Europe offer additional business models to consider. The consortium at JFK Terminal 4 that subcontracts but manages all ground services provides an alternate model. Munich Airport International is also an interesting example of an airport that formed an airport subsidiary, MUC Ground Services Flughafen Munchen to provide ground services.

## REDEVELOPMENT OF AIRPORT FACILITIES

### Airline Maintenance— Consolidation and Outsourcing

A wave of airline bankruptcies occurred in the first half of this decade. Among legacy carriers to file Chapter 11 were US Airways and United Airlines in 2002 and Delta Airlines and Northwest Airlines in 2005. US Airways and America West subsequently merged, as did Delta and Northwest. As part of bankruptcy proceedings and consolidation, these airlines actively shed many of their airport assets and long-term leases.

The list of facility closures was long; notably, United vacated two very large maintenance facilities, one in Indianapolis and the other in Oakland. U.S. Airways closed its Pittsburgh hub and a maintenance hangar in Tampa. Northwest abandoned its Airbus maintenance facility in Duluth, Minnesota. Delta had already closed its Dallas/Ft. Worth hub, its maintenance facility, and dramatically reduced freight operations.

For the affected airports, the revenue and planning implications were large. For example, at Oakland International, United held a long-term lease on its 300,000 square-foot maintenance facility built in 1971, and had substantially upgraded the building and paid the airport \$330,000 per month for its lease. The long-term nature of the lease had been anticipated and built into financial projections and plans for an expanded third terminal. United gave 27 days notice that it was vacating the property.

It is also not uncommon that a property in bankruptcy remains in financial limbo for some time. For example, when US Airways closed a maintenance hangar at Tampa International, there was remaining debt on the property, which had been funded by special purpose facility bonds. The Bank of New York was the trustee of the bond and had two years to find an alternate tenant. The Trustee tried to rent the property for a price that would cover debt service, but the market was soft and the property remained vacant. The Trustee received a two-year extension and tried for a total of four years to lease the property. During that time the Hillsborough Airport Authority received no rent on its land lease. After the Trustee's interest expired, the bonds defaulted and the building reverted back to the Airport Authority. The airport invested approximately \$400,000 to meet safety codes and prepare the property to be leased. Six months later PEMCO MRO signed a lease that included a ground lease, a minimum facility rent, and a percentage of gross revenues if revenues exceeded a certain target.

The maintenance facility in Duluth was also the subject of a complex bankruptcy proceeding. Construction of the facility for use by Northwest Airlines was financed in 1995 by \$47.6 million in state of Minnesota bonds. Under the terms of the original financing agreements, Northwest Airlines had provided certain assets as collateral, securing its obligations on the bonds. Following a strike by Northwest mechanics in August 2005, Northwest closed the facility and then filed for bankruptcy the following month. A total of \$35.8 million of debt service remained on the bonds. The city of Duluth, St. Louis County, and ALLETE, Inc., continued to make payments on the debt service. In July 2007, an agreement was made and approved by the U.S. Bankruptcy Court that paid the state of Minnesota an amount sufficient to fully redeem the outstanding state bonds and the amounts that the city, county, and ALLETE had also paid. The maintenance facility was turned over to the Duluth Economic Development Authority debt free, which then leased the property to Cirrus Aircraft headquartered in Duluth. However, Cirrus moved out of the hangar in September 2009.

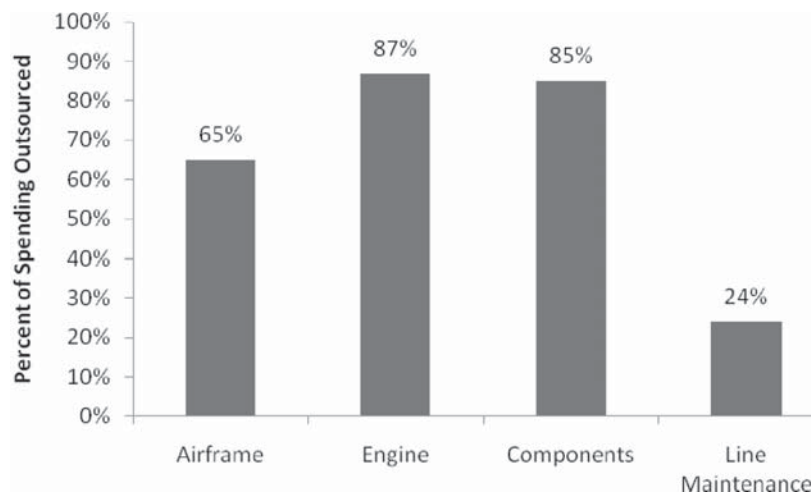


FIGURE 25 MRO outsourcing—2009. *Source: State of MRO Industry 2009, Spafford et al., Oliver Wyman, Inc. (2009).*

Although airline bankruptcies were the immediate cause of many distressed properties, a change in the way airlines handle their maintenance programs explains why these particular facilities were jettisoned by the airlines during bankruptcy and why some airports have had difficulty finding replacement tenants. Three decades ago, U.S. air carriers performed more than 80% of their maintenance in-house; today, overall, it is less than 20%. Figure 25 shows a breakdown of dollars spent on outsourcing.

Heavy MRO facilities can be remotely located. An airport actually competes for this type of facility in an international marketplace where MROs in Central America, Latin America, and Asia offer lower-cost service contracts. The MRO business is tied directly to the airline industry. Decreases in active aircraft and cancellation of aircraft orders have not only impacted the MRO industry but also original equipment manufacturers (OEMs), who are looking to replace lost revenues and focus on aftermarket opportunities. The lines between aircraft and engine manufacturers and MROs are becoming blurred because OEMs are using MROs for order fulfillment or competing directly with them. As long as demand from the airlines stays the same or declines, competition from MROs and OEMs is likely to remain aggressive. It is in this context that airports holding large and vacant maintenance facilities will need to critically evaluate their relevance and prospects for redevelopment. At Oakland International Airport, there are plans to demolish the former United Maintenance hangar and redevelop the apron for cargo handling.

#### Indianapolis Maintenance Center

Similar to the situation at Oakland International Airport, United Airlines operated a large maintenance facility at Indianapolis International Airport. This was a newer facility, built in 1994, and it was also larger, in excess of 1.7 million square feet. The facility is located on 217 acres and includes hangars, machine and fabrication shops, offices, warehousing,

vehicle parking, a retention pond, central power plant, and aircraft apron. The hangars can accommodate both regional jets and wide-body aircraft (see Figure 26).

In 2004, United bankruptcy proceedings resulted in the Indianapolis Maintenance Center (IMC) reverting to the Indianapolis Airport Authority. The Authority realized that it was unlikely to find one tenant to occupy the entire complex, so the airport devised a segmentation strategy to make the facility market attractive to multiple tenants.

In 2004, the Authority leased approximately 750,000 square feet to AAR Aircraft Services, Inc., including 10 of the 12 hangar bays. The initial term of the lease is ten years, with an option to extend for an additional ten years. The Authority

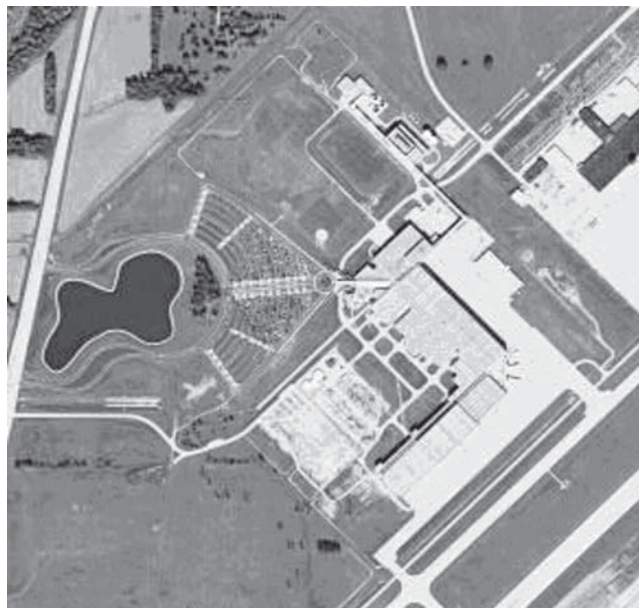


FIGURE 26 Indianapolis Maintenance Center. *Source: Indianapolis Airport Authority.*

has six other leases related to the IMC as well as one concessionaire agreement. These leases are for other sections of the facility and include the remaining two hangars, the office area, and certain portions of the land. There is little space remaining at the facility that is not leased, with approximately 43,000 square feet of warehouse space still available at the time of this report (see Figure 27).

As of December 31, 2008, the Authority and the Trustee continued to hold approximately \$172 million of special facility revenue bonds that financed the IMC. In Chapter 11, United rejected their lease and abandoned the facility. As part of the Settlement Agreement, all rents collected for space in the IMC must be deposited in a trust on behalf of the United Airlines bondholders. However, these funds in trust are used to pay the ongoing operating and maintenance costs of the IMC including reimbursement of past capital and operating costs, payment of ground rent, and debt service. The Authority is able to offer “incentives in the form of grants and credits to assist start-up costs and the acquisition of certain capital assets. These incentives can also be used to encourage the tenant to expand operations and/or increase the amount of space they lease. All capital assets acquired with grants and credits remain the property of the Authority. At the end of 2008, the Authority has provided \$6 million in grants and \$3.9 million in rental credits to the lessees of the IMC” (Indianapolis Airport Authority 2008).

### Lessons Learned

In each example presented, airports were faced with important decisions concerning what to do with abandoned maintenance

bases. The large number of maintenance facilities rejected during Chapter 11 proceedings speaks volumes about changes in how airlines are implementing maintenance programs and how airports or their governing bodies need to take a hard look at the most feasible reuse of abandoned facilities. The airports discussed here applied vastly different strategies. Oakland International Airport ultimately decided that demolition of the UAL maintenance facility made the most sense in terms of its long-term land use objectives. Duluth Economic Development leased its maintenance facility to an important existing airport tenant for research and development, but the recession forced Cirrus Aircraft to vacate the premises. The Indianapolis Airport Authority subdivided its property, and the Hillsborough Airport Authority (Tampa) was able to refurbish and lease the US Airways maintenance hangar at favorable terms to another MRO.

For assets that revert to local government or airport sponsors during bankruptcy proceedings, settlement agreements are extremely important in determining when a facility becomes available for reuse and what, if any, financial obligations for debt service are associated with the facility. Settlement agreements can be complex to implement.

Airlines have outsourced maintenance, repair, and overhaul for about ten years. Within the industry, outsourcing is now also taking place for training and ground service programs. United Airlines is currently phasing out internal training programs in favor of outsourcing; other airlines already outsource training. Although dedicated training facilities need not be located at airports, they do represent potential excess real estate for the airlines.



FIGURE 27 Schematic of the Indianapolis Maintenance Center.  
Source: Eliot Lees, SH&E (2005).

## NON-AERONAUTICAL DEVELOPMENT

### MULTI-USE DEVELOPMENT

Several airports in the United States and Canada have undertaken very large development projects that will diversify activity on airport property and provide alternate revenue streams. The land available for development is sometimes so large that airports and their governing bodies have subdivided it into parcels and planned for specific development on certain sites. Plans for these parcels include general aviation development, air cargo and logistics centers, hotels, convention centers, office parks, intermodal centers, retail malls, industrial parks, golf courses, and sport arenas. Multi-use developments are inevitably complex, involving public and private partners, FAA assurances and obligations, extensive site preparation, and financing through a combination of grants, bonds, private capital, and tax abatements. For these large developments there is often innovative marketing and financing. The airports have a clear understanding of their market strengths; however, in a weak economy there also appears to be no shortage of opportunities for an investor or developer. Highlighted here are several multi-use developments that demonstrate the diversity of non-aeronautical activity under consideration or in the works. Each deserves a full case study:

- Pittsburgh International Logistics Centre—headquarters campus for Dick's Sporting Goods.
- Kansas City Business Centre—air and truck intermodal center.
- El Paso International Airport—broad portfolio of businesses at the airport to capitalize on Mexico/U.S. trade opportunities and defense and military contract synergies with Biggs Army Air Field.
- Edmonton International Airport (Port Alberta)—intermodal project that connects heavy rail, road, and air with the Prince Rupert deep water port and midwestern U.S. cities.
- Miami Intermodal Center—an extensive ground transportation hub.
- Southwest Florida International (Skyplex)—ambitious reuse program for former airport terminal site.

#### Pittsburgh International Airport

Pittsburgh International Airport has 4,262 acres available for development; 13 parcels (3,076 acres) that can be used for non-aeronautical purposes, and 5 parcels (1,186 acres) (A–F) that are located adjacent to the airfield and reserved for

aeronautical activity (see Figure 28). The Allegheny County Airport Authority has partnered with the State Economic Development Agency and is pursuing industrial, research and development, office complexes, and additional development for airport use.

On-going is the development of Pittsburgh International's 440 acre North Field Site, which includes Dick's Sporting Goods Headquarters and the PIT International Logistics Centre, located within Foreign Trade Zone #33. Dick's Sporting Goods is leasing 116 acres of the land from the airport and building a \$150 million, 670,000 square-foot building and a 60,000 square-foot aviation center. To move the project ahead, the Allegheny County Redevelopment Authority is serving as a conduit to receive a \$7.25 million grant to complete the necessary infrastructure. Dick's also received a 10-year, 50% tax abatement that is capped at a maximum of \$825,000 in property tax savings.

The second project on the North Field site is a public–private partnership between the Airport Authority and developer Trammell Crow Company. The Logistics Centre is a planned industrial park located within a foreign trade zone, which offers companies the opportunity to reduce or eliminate duties on imported goods (see Figure 29). The Authority is preparing the site and the developer will build two speculative buildings, ranging from 100,000 to 220,000 square feet, designed to house freight forwarders or other logistic operators. The buildings are the first phase of an eventual \$88 million development on 160 acres. Site improvements were paid for through a \$5 million tax-increment finance bond, \$2 million from the Airport Authority; and a \$700,000 grant.

#### Kansas City Intermodal Business Centre

The Kansas City Intermodal Business Centre is a two-phased \$232 million project that broke ground in October 2008 (see Figure 30). Trammell Crow Company is managing the development. Full build out involves an 800-acre multi-use development. Phase 1 of the project involves site infrastructure including roads and utilities on a 180-acre parcel south of the American Airlines overhaul base. There is good access to four Interstate highways; therefore, the modal transfer between air and truck will be emphasized. Phase 1 will offer infrastructure to support about seven buildings comprised of approximately 2.7 million square feet of commercial space suitable for light manufacturing as well as intermodal distribution and logis-

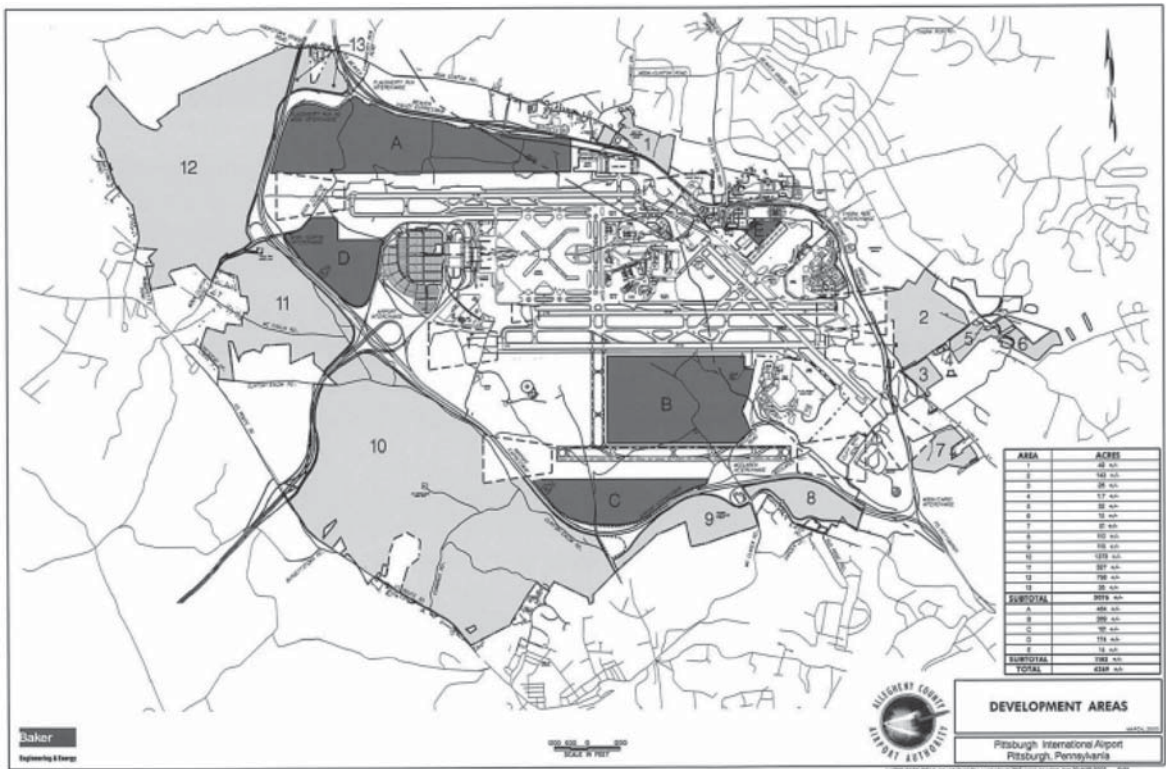


FIGURE 28 Pittsburgh International Airport Development Areas. *Source:* Allegheny County Airport Authority.

tics. The first building will be a 494,000 square-foot distribution center. As with Pittsburgh's North Field development, the site is located within a very large foreign trade zone. The Kansas City Aviation Department will lease the land. Two million dollars of local funds has been put into site preparation.

### El Paso International Airport

El Paso International Airport offers a striking example of diverse non-aeronautical land development. The airport



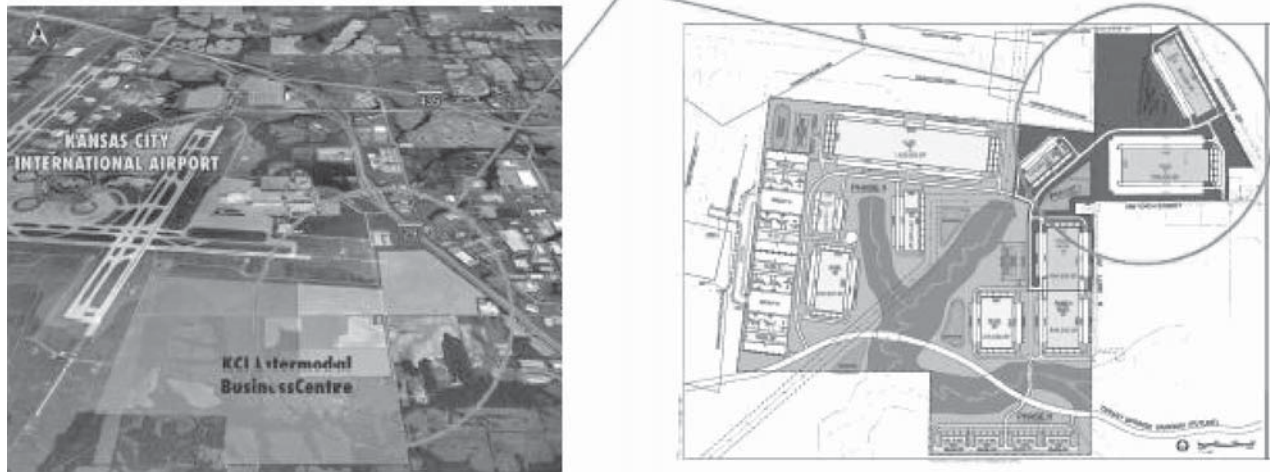
FIGURE 29 Rendering of the Pittsburgh International Logistics Centre. *Source:* Allegheny County Airport Authority.

has 7,100 acres and is strategically located at the crossroads of west Texas, southern New Mexico, and northern Mexico and in close proximity to the Biggs Army Air Field (see Figure 31).

The airport has focused on its strategic location to develop a "borderplex" that capitalizes on international commerce. Currently on airport property are the following non-aeronautical facilities in place or planned:

- Two industrial parks supporting more than 200 commercial businesses and industrial operations.
- A foreign trade zone.
- The Butterfield Trail Golf Club, including an 8,800 square-foot club house and a signature golf course designed by Tom Fazio that opened in 2007. The airport is seeking a resort hotel development in association with the golf course.
- Development of the Butterfield Trail Air Cargo Center is underway. This \$60 million investment includes two air cargo buildings (288,000 square feet), 34 acres of aircraft parking, and 6.4 miles of roadways. The buildings are now 70% occupied and are intended to capitalize on North American Free Trade Agreement-driven U.S./Mexico trade.
- The Texas Department of Transportation is a partner in constructing an inner loop road that will provide access to Mexico's manufacturing base in east Juarez and to Ft. Bliss/Biggs Army Airfield. The airport would also

Phase 1

FIGURE 30 Kansas City Intermodal Business Centre. *Source:* flykci Newsletter, September–October 2008.

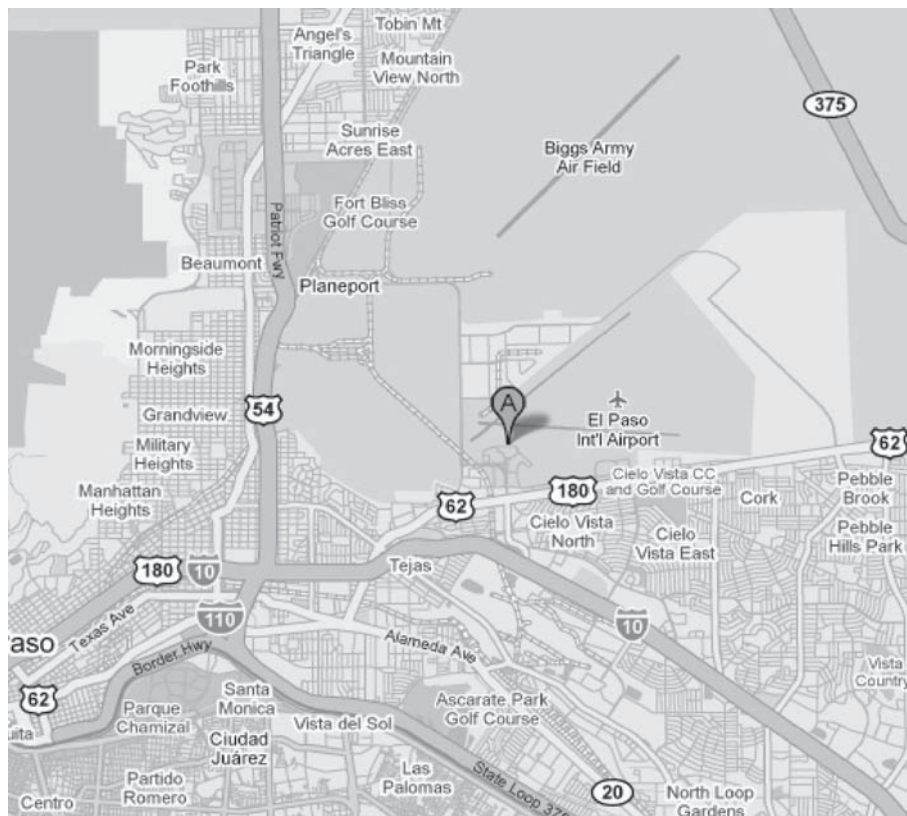
like to develop an industrial park that supports defense contracts at the army base.

- Seven hotels also operate on airport property.

For El Paso International Airport, aeronautical operating revenues provide 40% of total operating revenues and non-aeronautical revenues contribute 60%. Rent from land and non-terminal facilities is an unusually large proportion of the operating revenue (see Figure 32).

#### Edmonton International Airport—Port Alberta

Edmonton International Airport is the fifth busiest Canadian airport, handling 6.4 million passengers in 2008. It is the largest airport by area covering more than 7,000 acres, with 3,000 available for development. It is a designated transshipment zone similar to foreign trade zones in the United States. The Port Alberta project is in its early planning stages. The concept here is a global inland port that is a hub for export of

FIGURE 31 Proximity map for El Paso International Airport. *Source:* Google Maps.

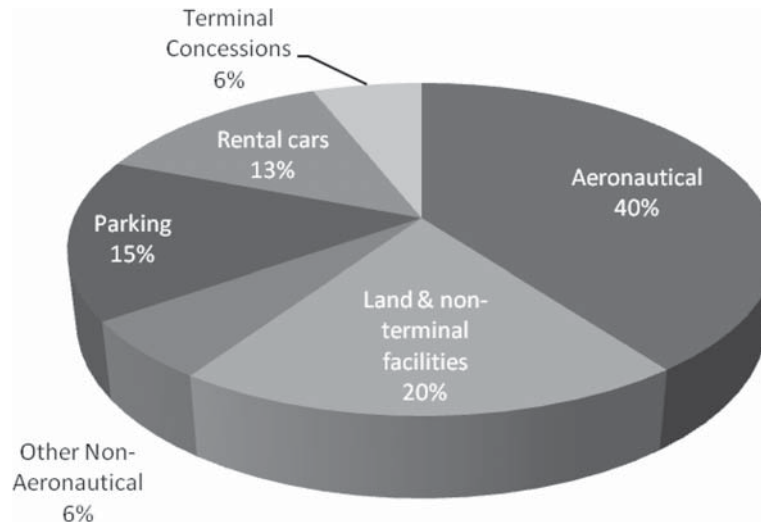


FIGURE 32 El Paso International Airport 2008 operating revenues. *Source:* FAA, AAS-400: CATS: Report 127.

Canadian resources and a transshipment point for products streaming east and west and southeast to the U.S. Midwest.

- Alberta has the second largest oil reserves in the world.
- Port Alberta would connect northern timber products, petrochemicals, and agricultural products to consumers around the world.
- It would serve as one of North America's leading warehousing and distribution hubs.
- Edmonton is the first major city east of Prince Rupert with direct access to North American wide road transportation networks, including the Yellowhead Highway, a major truck route for paper, lumber, plastics, and specialty grains (see Figure 33).
- The port concept offers wide air transport trade corridors across to Hong Kong or Shanghai, Chicago, Dubai, London, and Frankfurt (see Figure 34).

Port Alberta is particularly interesting because its sponsors view the project in terms of global movement of resources and product. Its success as an inland port depends on the true integration of existing rail, road, and air systems. Canada's newest deepwater port is Prince Rupert in British Columbia. Prince Rupert's competitive advantage over west coast U.S. ports would be transit time and lower operating costs. The challenge is to out-compete west coast ports and Calgary. If products from China, Korea, Japan, and India can be brought to Prince Rupert and offloaded for transshipment from Port Alberta to U.S. midwestern cities, the plan may gain traction. The Port Alberta project is counting on west coast ports in the United States becoming increasingly congested marine facilities, and that it can provide seamless and rapid transfers between modes.

Currently, the first two components of Port Alberta are underway through a partnership consisting of the Edmonton Regional Airports Authority, the Edmonton Economic Devel-

opment Corporation, the Chamber of Commerce, and the city of Edmonton. Western Economic Diversification Canada contributed \$2.26 million to develop a plan for Port Alberta and to establish a logistics support center that will serve as a one-stop cargo processing facility using the Smart Port Platform, an information technology to track and monitor cargo.

#### Miami Intermodal Center

MIC is a massive ground transportation hub located across from Miami International Airport (MIA) (see Figure 35).

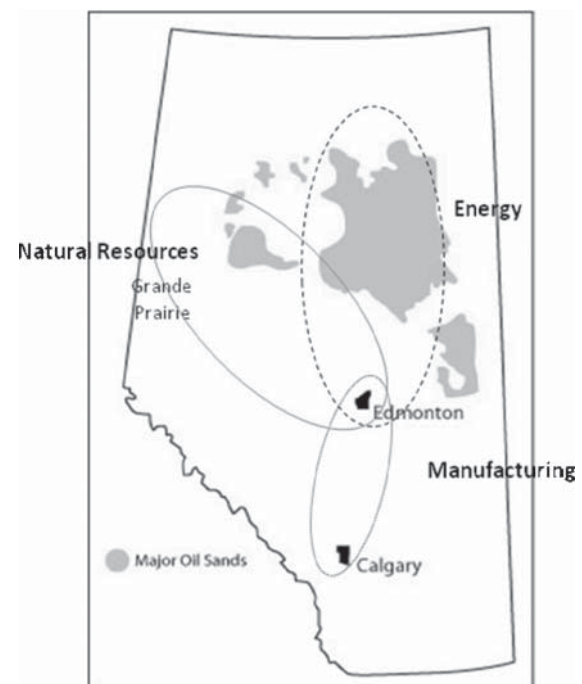


FIGURE 33 Regional distribution at Edmonton, Alberta. *Source:* Janet M. Riopel, Project Lead, Port Alberta.



FIGURE 34 Canadian Gateway Vision. *Source:* Janet M. Riopel, Project Lead, Port Alberta.

The project dates back to the early 1980s when Dade County recognized that individual modal development required greater “connectivity.” The project already has a long history and involvement of many federal, state, and local agencies and stakeholders. To overcome the challenge of coordinating costs, permitting, and schedules, a Steering Committee of 12 participating groups oversees the project. Initial construction began

in 2001 and completion is scheduled for 2012. Total project cost is \$1.7 billion.

The MIC program includes a rental car center, the Miami Central Station, major roadway improvements, the MIA Mover, and a real estate development plan. The facility will serve as a hub for regional rail, Amtrak, buses, shuttles, private vehicles, rental cars, and taxis. The MIA Mover is a light rail system that runs between the airline terminals, the rental car center, and the station. An important element of the project is economic development of the area. The real estate development component has the potential for 1.4 million square feet of mixed-use development in and around the MIC. The Florida Department of Transportation owns the land and may either lease or sell parcels for hotels, office buildings, parking, retail, or restaurants.

#### **Southwest Florida International Airport— Skyplex Commercial Center**

Southwest Florida International Airport opened its new Midfield Terminal in 2005 (see Figure 36). After much consideration, the Lee County Port Authority decided to demolish the old terminal and undertake a large commercial multi-use development on the north side of the airport to include:

- 75 acres of ramp accessible property for dedicated aviation use (old terminal site),
- 715+ acres for non-aviation development,
- Full federal inspection facilities to process international shipments,
- Entire airport being designated as a foreign trade zone, and
- Existing roadway access and utilities.



FIGURE 35 Miami Intermodal Center. *Source:* Florida Department of Transportation, MIC Program (2009).



FIGURE 36 Southwest Florida International Airport Skyplex. *Source:* Lee County Port Authority.

The Skyplex area already has an FBO/Gulfstream MRO facility, two cargo buildings, another FBO and airline fuel farms, rental car facilities, and a flight kitchen. In 2008, the Port Authority signed a ground lease on an initial 25 acres with an affiliate of John Madden Company for the development of an office park to be used primarily for medical research and development. The lease has options to expand development to approximately 145 acres. The first phase is in the final stages of permitting. The Port Authority is also negotiating with a hotel developer.

The Port Authority is anticipating that all aviation development will be subject to FAA obligations and assurances as well as any limitations imposed by local zoning and the Lee County Port Authority Minimum Standards for Commercial Aeronautical Activities. The FAA has already approved a revised ALP. The Authority does not anticipate that it will partner or joint venture in any private business or development except to offer a ground lease.

#### **OTHER REVENUE DIVERSIFICATION DEVELOPMENT**

In addition to large development projects airports are engaged in the development of other facilities that provide services to passengers or offer low-impact complements to aeronautical activity.

#### **Convenience Stores**

Convenience stores are common within airport terminals and now also as stand-alone facilities. The emphasis here is on

regular size packaging of personal care items at a reasonable “street” price. Vancouver International Airport was the first airport in North America to construct a 7-Eleven store in the terminal. The Dallas/Ft. Worth International Airport now has four convenience stores and one Shop 24, a large vending machine that offers more than 200 items. Everything ASAP, a store featuring travel items and gifts, has branches at the airports in Buffalo, Detroit, Minneapolis, and New York.

#### **Gas Stations**

Many airports have developed airport gas stations for passengers and employees. Examples of stand-alone gas stations at airports include Sacramento, Newark, Pittsburgh, and Denver. Typically, gas stations are paired with convenience stores.

#### **Health Clinics and Drug Stores**

Airports are experimenting with a variety of approaches to preventative and urgent care for travelers and employees. Pharmacies and walk-in health clinics are now available at many U.S. airports. They are set up to serve as urgent care stations and also to offer a limited number of medical services and medications. The clinics are situated before security screening and can serve travelers, their families, employees, and walk-in traffic. Many clinics offer free parking validations. The model takes advantage of longer wait times at airports and a trend toward retail clinics already available in mass market areas such as shopping malls or big box stores. Solantic, which operates walk-in clinics throughout Florida including several in Wal-Mart stores, has opened a clinic at Orlando International Airport. This clinic is open 13 h a day, 7 days a week,

and employs between 15 and 20 medical professionals, including two board-certified physicians. The clinic expects to treat 20,000 individuals per year including both employees and air travelers.

Aero Clinic has clinics at Atlanta, Philadelphia, and Charlotte airports. These clinics focus on common requests of air travelers including ear infections, stomach aches, the checking of cholesterol and blood sugar levels, flu shots, heart medications, physical therapy, and asthma inhalers. Although most clinics take health insurance and Medicare payments, specific services are fixed price and posted.

The SFO Medical Clinic is set up for a much broader audience and services. The clinic is located before security in the San Francisco International Terminal. It serves as a certified vaccination center that offers immunizations advised by the World Health Organization and the Centers for Disease Control. As a service of the St. Mary's Medical Center, the clinic also functions as an urgent care facility and participates in several preferred provider organizations. The clinic gives discounts for direct payments in cash or with credit cards. The clinic also offers occupational health for employees in the treatment and management of work-related illness or injury, including health and wellness, job site analyses, and injury prevention. The clinic provides FAA flight physicals and Immigration and Naturalization physicals, as well as after-hour drug testing.

Inside terminals drug stores sell an assortment of over-the-counter medications, personal care items, office supplies, and blood pressure monitoring machines. OTC Drugs and More has stores at the Phoenix and Raleigh-Durham airports and markets its products as full-size containers at "street-pricing."

Harmony Pharmacy, located in Newark Liberty Airport and Terminal 5 at JFK Airport, specializes in filling prescriptions and providing sundries and other travel products. Nurse practitioners provide some basic primary care services as well.

## Hotels

On-airport hotels are common at most large airports; however, it is not always the case. Plans are underway for Denver's first on-airport hotel.

A new trend at airports involves hotel rooms for passengers in transit. San Francisco International Airport is contracting with a concessionaire to construct and operate what it is calling "sleep units" in the international terminal behind security. The units would be a collection of Japanese-style pods or capsules that air travelers could rent by the hour. Such rooms would include a bed, desktop, data outlets, and a restroom, and would be available for a nap or to allow travelers to get organized before meetings. Westernized versions of these facilities are now available in Europe at London's

Gatwick and Heathrow airports and in Amsterdam's Schiphol Airport, and are operated by the Yotel chain.

## Pet Kennels

On- or near-airport pet kennels have become very common. Continental Airlines operates the first airline-owned on-airport kennel at its Houston Bush International Airport cargo facility. The kennel provides 1,100 square feet of space for runs and exercise pens. It also can separate species into different rooms. Many options are available for day or overnight visits and pet services.

Both private and nonprofit organizations are offering pet kennels near airports. Now Boarding, an affiliate of the Humane Society, opened a \$4.5 million facility near the Minneapolis-St. Paul International Airport. This is a 24-h pet boarding facility with parking and airport shuttle service, overnight boarding, dog training, and spa treatments.

Private vendors are operating kennel facilities near Houston Bush International, Houston Hobby, Charlotte International, Indianapolis International, New Orleans International, Chicago O'Hare, Jacksonville International, Portland (Oregon), and Los Angeles International airports.

AFCO (Aviations Facilities Company Inc.) is combining airport parking and pet boarding. The concept is to "drop off the pet and the car, shuttle to the airport." The AFCO facility has been developed as an upscale first class kennel for 200 to 250 pets, operating 24 h per day, 7 days a week. The development program involves \$2 to \$4 million in private capital improvements; a building of 25,000 square feet on 2.5 acres with a small outdoor play area. Total development time is estimated to be less than one year.

## Recreational Facilities

Many airports now have golf courses, soccer fields, parks, bike riding and running trails, hockey rinks, swimming pools, and go-kart and motorsport tracks. These developments are excellent ways to diversify revenue, offer low-impact activity at airports, and bring non-airport users to the airport property. Table 4 provides a sample listing of airports that have golf courses and other recreational facilities on airport property. The golf courses, sports centers, and tracks are usually operated by third parties.

Centennial Airport in Colorado, the third busiest general aviation airport in the United States, has actively sought development of recreational facilities on airport property because they are typically low impact and do not exhibit the same economic cycles as aviation. The Family Sports golf course, an ice arena, indoor sports field, and miniature golf course are located on airport land. These facilities are part of the South Suburban Parks and Recreation system offering recreational

TABLE 4  
ON-AIRPORT RECREATION FACILITIES

Airport	Code	State	Golf Course	Bicycle Trail	Walking Paths	Sports Center	Motor Sports
Aruba Queen Beatrix International	AUA	Aruba			X		
Baltimore Washington International	BWI	MD		X	X		
Centennial	APA	CO	X			X	X
Cheyenne	CYS	WY	X				
Chicago OHare International	ORD	IL		X			
Colorado Springs Municipal	COS	CO	Proposed				
Dallas–Fort Worth International	DFW	TX	X				
Dane County Regional	MSN	WI	X				
Denver International	DEN	CO		X			
Edmonton International	YEG	AB	X				
El Paso International	ELP	TX	X				
Fort Lauderdale International	FLL	FL			X		
Fort Wayne International	FWA	IN	X				
Logan International (Boston)	BOS	MA			X		
George Bush Intercontinental	IAH	TX			X		
Houston William P. Hobby International	HOB	TX			X		
Kansas City International	MCI	MO					Proposed
Kelowna International	YLW	BC			X		
Lambert–St. Louis International	STL	MO			X		
Lincoln	LNK	NE			X		
Miami International	MIA	FL			X		
Mineta San Jose International	SJC	CA		X	X		
Minneapolis–Saint Paul International	MSP	MN		X	X		
Nanaimo	YCD	BC	X				
Norfolk International	ORF	VA			X		
Oakland International	OAK	CA	X	X			
Orlando International	MCO	FL			X		
Ottawa International	YOW	ON	X		X		
Philadelphia International	PHL	PA			X		
Phoenix–Mesa Gateway	PHX	AZ	X				
Port Columbus International	CMH	OH	X				
Ronald Reagan Washington National	DCA	DC		X	X		
Salt Lake City International	SLC	UT	X	X	X		
Sarasota–Bradenton International	SRQ	FL	X				
Savannah Hilton Head International	SAV	GA	X				
Southwest Florida International	RSW	FL			X		
Tucson International	TUC	AZ			X		
Victoria International	YYJ	BC		X			

Sources: ACI–NA and KRAMER aerotek inc. (2009).

activities for residents of the district. In addition, Centennial has leased airport property for a go-kart track, a Wings Over the Rockies Air and Space Museum, and a nonprofit child-abuse prevention program (see Figure 37). All of these projects are positive community facilities and fit into the airport's strategy to diversify revenues. The Track at Centennial is recognized as one of the nation's top tracks for hosting private parties and competitive kart drivers. The Track was also a way to use land for 20 years, while preserving the option to develop additional hangars on the parcel when the lease expires.

Kansas City International has also planned and designed a motorsports park. The concept is based on a country club model with membership and a clubhouse. The track will include two separate joinable tracks (3.7 miles), a Champion Standard Kart track, a driving school, and private garages.

The development program requires an estimated \$25 million in private capital, a 300-acre ground lease, and two phases of development that would span two years. In Phase 1, the clubhouse, one motorsport track, and the Kart track would be constructed. Phase 2 adds the South Track, garages, and additional team units. Construction plans are on hold pending an improved economy.

## Storage

### Self Storage

Airports have operated other ancillary businesses on the airport. Sarasota–Bradenton Airport owns and operates University Self Storage, a storage warehouse with air-conditioned and non-air conditioned spaces for rent.



FIGURE 37 Track at Centennial Airport. (Source: Mitch Bowers at [www.imagerwerx.us](http://www.imagerwerx.us).)

*Cold Storage*

In the 1990s, the Greater Orlando Aviation Authority built a 34,000-square-foot refrigerated warehouse to compete with Miami air cargo handlers. The market for flowers and other perishables proved a difficult entry and the Authority sought to lease the property to a third party. Anchorage International Airport successfully rents out cold storage lockers in the airport to passengers needing to store fish and game in transit.

**Savannah/Hilton Head Revenue Diversification**

Savannah/Hilton Head International Airport is a good example of an airport that is broadly diversifying its portfolio of non-airline businesses. In 2008, non-aeronautical operating revenues represented approximately 47% of total operating revenues (\$151 million); however, because Savannah/Hilton Head is a destination airport, there is a large component of non-aeronautical that is passenger-dependent (FAA: AAS-400: CATA: Report 127). The airport has also actively pursued ancillary development on its 3,600 acre property. In addition to providing ground handling services for airlines and charters, the airport has operating revenues from the following ancillary activities (Ruaback 2009) (see Table 5):

**Government Facilities on Airports**

Government agencies and emergency response groups are frequent tenants of airports. Sometimes these agencies build their own facilities or lease space directly from the airport or a third party. Government groups include:

- Aeronautics divisions of a state’s department of transportation
- Civil Air Patrol
- MEDEVAC—emergency airlift services
- Military joint use
- National Center for Atmospheric Research (NCAR)
- National Guard
- National Oceanic and Atmospheric Administration (NOAA)
- State police
- U.S. Transportation Security Administration (TSA)
- U.S. Customs
- U.S. Forest Service
- U.S. Postal Service.

TABLE 5  
SAVANNAH/HILTON HEAD INTERNATIONAL AIRPORT  
ANCILLARY BUSINESSES

Business	Estimated 2008 Revenues
Golf Course	\$62,000
Convenience Store	\$29,000
Hotels (14)	\$888,000
Restaurant	\$72,000
Federal Express Building Finance	\$120,000
Chatham County Mosquito Control Project Finance (estimated)	\$276,000
Office Space (old airport)	\$8–\$10 per sq. ft
Air Tran Reservations (old airport)	\$69,000
Logo Berms (estimated)	\$50,000
Ground Handling	\$440,000
Foreign Trade Zone	\$302,000

Source: Savannah/Hilton Head Airport, estimates by KRAMER aerotek inc.

## ANCILLARY LAND USE

Land use at airports is subject to FAA Grant Assurance 21, Compatible Land Use, and local zoning ordinances that strive to protect airport approaches and to ensure that development is compatible with aircraft operations and noise. Within the land use framework, airports are pursuing interesting ways to generate alternative revenue. This chapter highlights ancillary land uses at airports that generate additional operating revenue.

### ADVERTISING AND SPONSORSHIPS

Much has been written about revenue generation through advertising in terminals. Media opportunities are plentiful within the terminal. Today, airports have taken steps to increase advertising and sponsorships beyond the terminal through selling (see Figure 38):

- Advertising on unpaved land on the airfield or approaches to the airport
- Banners on sky bridges
- Naming rights on airport buildings
- Road cleanup sponsorships.

In 2004, Toronto Pearson International Airport embarked on an ambitious advertising program inside and outside the terminal. The Greater Toronto Airport Authority (GTAA) recognized the revenue potential, but had many concerns about the negative impacts of such advertising. In 2004–2005, GTAA introduced inside the terminal large LCD (liquid crystal display) screens at baggage claim and on the walls in gate areas; other screens broadcast news programs. In 2005–2006, GTAA focused on industry displays. Several car companies displayed new models. American Express and CIBC set up kiosks. In 2006–2007, Intel introduced pole wraps and wall advertising, and Cisco set up a specialty display. In 2007–2008, Samsung put up a large cell phone display outside the terminal, and HSBC advertised on jet bridges. The airport also sold advertising space on elevator doors and banners in the Grand Hall. In 2009, a panoramic glass mural was installed (see Figure 39). Gross sales from advertising at the airport have grown from \$6 million in 2004 to more than \$16 million in 2008.

### TEMPORARY USES AND SPECIAL EVENTS

Airports provide land and facilities for many temporary uses on the airfield, in parking areas, and in unused buildings or land. Government agencies use airports as staging areas to fight fires, respond to other emergencies, test equipment and

aircraft, and carry out training sessions. Airports serve as sets for television and movies. Van Nuys Airport and Bob Hope Airport (Burbank) are regular filming locations.

Airports can also lease out land for temporary storage of vehicles and equipment or event parking. Open houses, air shows, rodeos, fundraisers, and fairs are all special events that take place at many general aviation and some commercial service airports on the airfield, on open land, or in vacant hangars. Annual air shows such as the Experimental Aircraft Association AirVenture at Wittman Regional Airport in Oshkosh, Wisconsin, or the Fly-in at Kissimmee Gateway Airport in Florida attract a significant amount of aviation activity and commerce.

### EASEMENTS AND RIGHTS-OF-WAY

Easements for utilities and roads as well as water rights are other potential sources of income for airports. There are a large number of legal decisions involved in these matters; however, most fees and agreements are handled on a case-by-case basis. Both Colorado Springs Municipal Airport and Albany International Airport have recent experience negotiating easements or rights-of-way.

### AGRICULTURE

Many airports lease out land for agricultural use. Denver International Airport leases out approximately 16,000 acres of farmland on a per acre basis to local farmers (see Figure 40). Under the lease program, farmers raise such crops as wheat, sunflowers, millet, and corn. Farm revenue from the sale of crops is divided, with one-third going to the airport and two-thirds to the farmers. In 2007, farmland leases brought in \$300,000 in non-aeronautical operating revenue.

### MINERAL EXTRACTION

The Dallas–Ft. Worth International Airport (DFW) has leased 18,000 acres of airport land to the Chesapeake Energy Corporation. The company will pay a one-time bonus and yearly royalties to the airport. The initial term of the lease is two years to allow time to commence production. The lease thereafter remains in effect as long as there is drilling and extraction of natural gas.

The two-year lease is expected to produce non-aeronautical operating revenue of approximately \$180 million and royalty



FIGURE 38 Outdoor advertising at Johannesburg Airport. *Source:* Szizuo Kambayashi, Associated Press.

payments of 25% of natural gas revenues. The DFW oil and gas program was modeled after a similar project at Fort Worth Spinks Airport.

In 2007, 68 oil and gas wells were in operation at Denver International, generating revenue of \$2.5 million. In 2008, nine more wells were added.

In 2008, Greeley–Weld County Airport Authority, one of the largest general aviation airports in Colorado, entered into an agreement with Petro–Canada Resources to explore for oil, gas, and minerals on airport property. This arrangement provided for an initial payment and royalty interest in production. Up to 20 wells can be drilled on the airport. Much research went into where the exploration could take place so as not to disturb the airfield. The Authority is reserving revenues from oil and gas to pay for equipment replacement, building maintenance, and pavement repairs. Operating costs of the airport will continue to be funded from aviation activity, ground leases, and hangar rentals.

## RENEWABLE ENERGY

Airports are now taking the lead on renewable energy projects. Renewable energy has many positives for an airport because it tends to be low impact, good for airport public relations, and an alternative source of power to operate the airport. Although most renewable projects are undertaken to save costs, excess

power can be sold back to the utility company or to other airport tenants.

## Solar

Several airports have demonstrated the viability of photovoltaic systems. In 2008, Denver International completed a 2 megawatt system using more than 9,200 Sharp solar panels. The solar panels are ground-mounted arrays that use a single-axis tracking system that follows the sun during the day. The installation is located on 7.5 acres of airport property. The airport had no capital costs for the system as it entered into a Power Purchase Agreement. The system will generate more than three million kilowatt hours (kWh) of electricity each year.

In August 2009, the airport asked the Denver City Council to approve construction of a second solar system that will power the airport's fuel storage and distribution facility. This project will cost \$7 million to develop a 1.6 megawatt system on approximately 9 acres north of the airfield. The new system is expected to provide 100% of the fuel farm's electricity consumption. This system will also be financed through a Power Purchase Agreement with Xcel Energy.

Fresno Yosemite International Airport has also completed a solar installation. Fresno's solar system is located on a



FIGURE 39 Panoramic glass mural at Toronto Pearson International Airport. *Source:* Greater Toronto Airport Authority.



FIGURE 40 Farming at Denver International Airport. *Source:* Denver International Airport.

20 acre site that had few other alternative uses. The system has a 2.4 megawatt capacity and produces 4.2 million kWh of electricity per year. Originally the projected energy savings was \$13 million over the next 25 years; however, the savings are anticipated to be considerably more (Widmar 2009).

Oakland International Airport partnered with SunEdison to construct a 756 kW ground-mounted solar power system. The photovoltaic system will deliver approximately 1 million kWh per year. All of the power will be consumed by the airport under a long-term lease. In addition, the Federal Express west coast hub facility at Oakland is 100% powered by a roof-mounted solar array.

Other solar projects are planned for Hawaii and California. Hawaii's projects involve 34 megawatts on 12 sites with rooftop installations at the following airports: Kona, Honolulu, Lihue, Kahului, Molokai, and Lanai. Los Angeles airport officials are considering using 4,000 acres at the undeveloped Palmdale Regional Airport for a 100 megawatt solar power facility.

## Wind

Boston's Logan International Airport installed twenty 10-ft-tall wind turbines on the roof of its offices that airport officials expect will generate about 100,000 kWh a year, or approximately 2% of the building's monthly energy use (see Figure 41). The turbines could generate an annual savings of \$13,000 per year in energy costs, paying for themselves within ten years. Massport is considering the installation of turbines at its other airports in Bedford and Worcester.

Wind turbine technology has improved, resulting in smaller turbines. The Greater Rochester International Airport [(GRIA) Rochester, New York] will install wind turbines on the roof of the airport. Wind turbines, usually quite large, would normally disrupt radar signals for incoming and outgoing airplanes; however, the proposed turbines are smaller, no larger than 6 ft tall. The Green Energy Initiatives Project at GRIA will include the installation of two dozen, 1000-watt wind turbines and 50,000 square feet of photovoltaic system solar panels. The wind turbines are projected to generate 121,000 kWh and the solar panels 60,000 kWh of energy annually. To finance the project, Monroe County applied



FIGURE 41 Wind turbines at Boston Logan International Airport. *Source:* [www.capecodtoday.com](http://www.capecodtoday.com), Walter Brooks, Mar. 5, 2008.

for a grant from the New York State Energy Research and Development Authority, an Incentive Award from the NYS Solar Electric Incentive Program, and other available energy incentive awards to pay for a significant portion of the project. The remainder will be funded by the airlines operating at the GRIA through the Monroe County Airport Authority's Renewal and Replacement Fund.

## Geothermal

In 2007, a Massachusetts Institute of Technology research study found that mining heat that resides as stored thermal energy in the Earth's hard rock crust could supply a substantial portion of the electricity in the United States, probably at competitive prices and with minimal environmental impact. The first geothermal heating and cooling system at a U.S. airport will support the police annex at John F. Kennedy Airport. This project was announced in September 2007 and is still in the planning and design stage. Plans call for thirty-five 500-ft-vertical geothermal wells. A closed-loop system circulates a propylene glycol solution through the geothermal wells. In the winter the solution transfers heat from the earth to the building. In the summer the system is reversed, carrying heat away from the building and placing it in the ground, cooling the facility. Project sponsors estimate that the system could save \$100,000 a year in fuel oil and electricity costs.

Another airport geothermal project is scheduled to be operational in 2011 at Paris–Orly Airport. The Orly system is designed to take advantage of a large cache of hot water directly underneath the airport. Two 1,700 m shafts will be driven underground at the perimeter of the airport. Water heated by the earth's core will be drawn up by means of natural pressure, reaching the surface with a temperature of about 165°F. It will be circulated through the airport's heating system, heating the Orly–Ouest terminal, part of Orly–South, the airport's Hilton Hotel, and the Coeur d'Orly business center. The hot water will then be returned back into the earth through the second shaft. The system as planned will circulate 250 cubic meters (327 cubic yards) of water per hour and supply 35% of the airport's heating demand.

## Second Generation Biofuels

The use of sustainable biofuels for aviation is attracting significant attention. In December 2008 and January 2009, Air New Zealand, Continental Airlines, and Japan Airlines flew test flights with biofuel mixes in at least one engine (see Figure 42). Front Range Airport and Centennial Airport in Colorado are considering production of biofuel feedstock on airport property.

The production of first generation biofuels such as ethanol and biodiesel came from food crops such as sugar cane, rapeseed, and corn. These biofuels raised questions because if produced in large quantities they would adversely affect the price of food and compete for the use of agricultural lands. For aviation purposes, biodiesel and ethanol showed promise in replacing 100LL Avgas, but did not meet

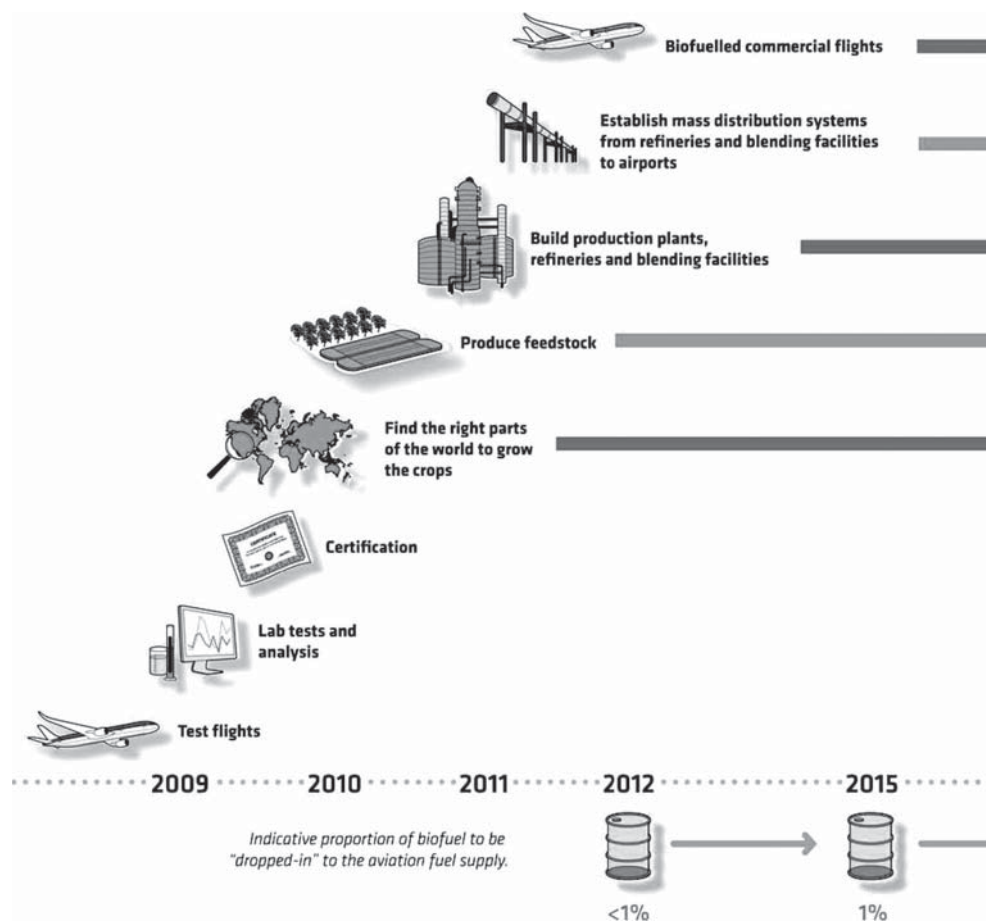


FIGURE 42 Sequence for development and use of biofuels. *Source:* Air Transport Action Group, *Beginner's Guide to Aviation Biofuels*.

the high performance standards or safety specifications for jet fuel. The next generation of biofuels is under development and has the attention of ACI, the major airframe and engine manufacturers, and the National Renewable Energy Laboratory based in Golden, Colorado.

The second generation of biofuel feedstock includes *Jatropha*, *Camelina*, *Algae*, and *Halophytes*. These feedstocks can grow in many parts of the world in non-arable areas and do not compete as a source of food (see Figure 43). Cultivation on airport property makes for an interesting synergy, assuming availability of adjacent refining capacity.

**UTILITY SERVICES**

The development of utility systems and services on the airport holds promise for generating electricity or providing water and sewer services for airport tenants and the surrounding areas. Many of the renewable energy systems proposed or now operational involve long-term purchase agreements at favorable rates. Geothermal heating and cooling solutions lend themselves to serving large portions of airport property. Airports can also purchase utilities wholesale from local providers and resell to airport tenants.

Front Range Airport recently completed a wastewater treatment facility with reuse capabilities. The water is not suitable for human consumption; however, a project is proposed to use the water in a pilot program to produce biofuel. More than half of the airport's 3,900 acres are planted in wheat by tenant farmers. The test program would use "field trash," the part of wheat left after harvesting, and pine trees killed by beetles. The

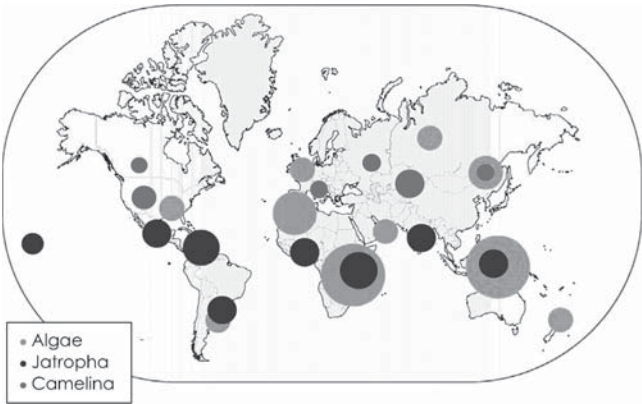


FIGURE 43 Optimum locations to grow aviation biofuels. *Source:* Air Transport Action Group, *Beginner's Guide to Aviation Biofuels*.

plant material would undergo a thermal chemical process called pyrolysis, which uses heat to speed up decomposition. The project financing will hinge on funding from a DOE grant.

#### **PRECIOUS METAL STORAGE**

In September 2009, Hong Kong International Airport (HKIA) opened the HKIA Precious Metals Depository. This 340 m<sup>2</sup> (3,660 ft<sup>2</sup>) vault will be used to provide secure storage and

physical settlement services to central banks, commodity exchanges, bullion banks, precious metal refineries, and issuers of exchange traded funds. In addition to safety and security, the Hong Kong airport location was selected to help reduce transportation costs and settlement risks for precious metals including gold, silver, platinum, and palladium. The selection of HKIA also solidifies the airport's position as a gateway to the Chinese Mainland, an international financial center, and logistics hub for high-value cargo.

## CONCLUSIONS

This synthesis examined the issues surrounding revenue diversification at airports and the different ways that airports are generating alternate sources of operating revenue. The business model for airports is clearly changing, partly in response to an environment where airline cost control, bankruptcies, and mergers have increased the risk at airports for unplanned vacancies, reductions in level of service, and renegotiated use agreements. Airport capital projects are typically planned around a 20- to 30-year horizon; far longer than long-term plans made by the airlines. To address the maintenance and capital needs of an airport, such facilities have adopted new cost-cutting measures, performance benchmark systems, and new initiatives to redevelop stranded facilities, attract new business, and create additional operating revenue.

The pathway to developing non-aeronautical activity at an airport is guided by (1) airport leadership, (2) market opportunities, (3) land use and zoning regulations at the local and state level, and (4) FAA grant obligations and assurances that protect the federal investment in airports and guide the type of activities allowed. There is also variation in state and local regulations concerning whether or how public entities can participate in private development.

The legal framework for revenue diversification at airports can be complex and in many instances has been addressed by the FAA on a case-by-case basis. Even at the airport sponsor level, governing groups vary as to how much latitude airport directors are given with respect to initiation of capital projects, joint ventures, and lease negotiations.

The FAA, through its financial reporting system, requires commercial service airports to report aeronautical and non-aeronautical operating revenue. The accounting categories for operating revenues make it difficult to discern how airports are diversifying beyond airline and passenger-dependent activity; however, it appears that for large and medium hub airports, non-aeronautical operating revenue derived from activities other than terminal concessions, rental cars, and parking represents a small percentage of the total operating revenue. For small and non-hub airports, and for general aviation airports, alternate sources of operating revenue are much more significant.

Many examples of revenue diversification activity at airports are presented in this synthesis. They occur for a variety of reasons: (1) to fill a gap of service at an airport, (2) to function

as a cost saving incentive to an airline, or (3) to provide a new source of operating revenue for the airport that takes advantage of unmet demand or a particular market niche. Airports are also engaged in activities that benefit the community more directly than the airport. This is often the case when National Guard or military facilities operate at an airport. Because of differences in an airport's objectives for revenue diversification, the cost-benefit evaluation must also be situation dependent.

Further research could include the future and systematic evaluation of ways that airports are engaged in revenue diversification. ACRP Project 01-15, *Assessing and Implementing Innovative Research Strategies—A Guide for Airports*, presents the opportunity to investigate alternative revenue strategies for airports and ways to measure their effectiveness.

This synthesis scratched the surface of a very large topic. In the process, several issues emerged that would benefit from further investigation.

### • Rate of Return when Airports Provide Ground Services

Some airlines routinely contract with airports for ground handling services. Other airlines also may contract for third-party ground handling when the number of daily departures is small. Several airports around the country provide these services on a "per-turn" basis. Airport-provided services are gaining traction with small hub and non-hub airports. Proponents argue that airport ground handling is good because it (1) generates revenue for the airport, (2) lowers airline costs, and (3) retains air service for carriers that might otherwise quit the market.

Ground handling services cut across many functional areas of the airport including fueling, maintenance, terminal, and ramp services. Some workers are employed full time for ground handling; however, there are also typically many employees that either work part-time or are working on-demand when ground handling services are required. Airports differ on their philosophy about whether ground services should be offered as a break-even enterprise or for revenue generation. Ground handling has been added to the list of incentives offered to airlines; however, it is not evident whether these services retain airlines or whether certain airlines now expect an airport to offer such services. Per-turn pricing for ground handling has transformed this aspect of aviation services into a competitively

priced commodity. Rate of return issues and economic benefits remain unexplored for many airport-operated ground services.

### • Tracking Airport Diversification

FAA compliance reporting is focused primarily on aeronautical activity and passenger-dependent non-aeronautical activities (e.g., parking, concessions, and car rentals). Ground lease and other revenue and expenses for non-aviation activity are reported at an aggregate level. Advocates for activity diversification are inclined to emphasize the revenue side rather than the cost side and rate of return. It is difficult to draw conclusions about which airport diversification activities result in the greatest economic benefits (i.e., net revenue, jobs, taxes, or indirect impacts) without further case studies and development of metrics that would facilitate comparisons across airports.

### • Regulatory Issues

When U.S. airports experienced steady growth of aeronautical activity, the issues of revenue diversification did not figure as prominently in development discussions. However, as airlines cut capacity or re-structure, many airports have experienced airline preferences for shorter leases and reduced airline investment in airport facilities. Revenue diversification into non-aeronautical activity has raised some regulatory issues that were discussed at the ACI-NA Legal Issues Conference (San Francisco, May 2009) and are addressed in the new *FAA Airport Compliance Manual*, published in September 2009:

- In what circumstances can an airport use revenues derived from obligated airport property for non-aeronautical uses that will achieve greater airport self-sufficiency?
- Considering that airport revenues come from many sources, when can an airport use revenues from “non-obligated” land and activities to subsidize, guarantee, or otherwise provide incentives for additional aviation activity?

- For airports that experienced “de-hubbing” or substantial downsizing, what are permissible uses of property obligated for aeronautical purposes but in excess of current demand?

The new norm for airports surviving in this economy is one where the airline industry remains risk averse with respect to long-term commitments for facilities and use of airports. In this environment, reconsideration and clarity on the use of aeronautical and non-aeronautical property and revenues makes sense and is worthy of further investigation.

### • Do Incentives Work?

The efficacy of incentives is a much debated subject among airports and economic development groups.

- Do incentives actually cause airports or localities to grow more rapidly than they would otherwise?
- How much of an incentive is needed to serve as a “tipping point” in favor of a particular airport or are the incentives expected from all candidate locations?
- How costly are incentives for an airport compared with the direct and indirect service, jobs, and revenue derived from the development?

Incentives offered at airports have become both standard practice and a matter of careful process because, with few exceptions, incentives must comply with FAA Grant Assurances concerning revenue diversion, unjust discrimination, exclusive rights, and requirements for an airport to be self-sustaining. At this time, FAA guidance on air service incentives has a more established set of policy standards than the use of incentives for non-aeronautical development.

The FY2010 ACRP Project 01-15, *Assessing and Implementing Innovative Research Strategies—A Guide for Airports* offers the opportunity to address many of the questions raised by this synthesis.

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## GLOSSARY

**Above and Below the Wing**—Used in conjunction with a description of ground-handling services, above the wing refers to catering and other cabin services as well as “in the terminal” passenger services. Below the wing refers to ramp services including baggage and cargo handling.

**Aeronautical Revenue**—Operating revenue that an airport collects from:

- Terminal rents—based on the amount of space an airline uses inside the terminal.
- Landing fees—a per plane charge, usually based on the weight of the aircraft.
- Other charges—specific fees for extra airport services (i.e., use of a jet bridge).

An airline does not have to have a signed contract to use an airport. However, an airline with a contract, called a signatory airline, enjoys special benefits, such as lower rates, that other airlines do not.

**Aeronautical Use**—An aviation activity that takes place on the airfield or at the terminal gates.

**Compensatory Agreements**—The airport operator assumes the major financial risk of running the airport and sets rates and charges to recover the costs of the facilities and services that airlines use.

**Connecting Passengers**—Passengers that disembark one aircraft and connect to another aircraft at the same airport.

**Cost Recovery**—Method of establishing rates and charges that recovers capital costs and operating costs.

**Current Dollars**—Value of a dollar adjusted for inflation.

**Enplanements**—Passengers boarding an aircraft.

**Hook-Up Fee**—A hook-up fee occurs when a ground service agent fuels an aircraft.

**Hub and Spoke Systems**—Hub and spoke describes one model airlines use to organize their network of service. Airlines operate hubs in a few cities where most of their flights originate. Service goes out to spoke cities. Hub and spoke systems give passengers from smaller cities much greater access to a variety of destinations as passengers connect at the hub on flights to their destination. The carriers in the United States that operate hub and spoke systems are: United Airlines, American Airlines, Frontier Airlines, Alaska Airlines, Air Tran Airways, Delta Airlines, Continental Airlines, and US Airways. Other carriers operate point-to-point service, although carriers such as Southwest Airlines and Air Tran operate focus cities where it is possible to make connections.

**Large, Medium, Small, and Non-Hub Airports**—FAA defines large hubs as having 1% or more of total national annual passenger boardings. A medium hub airport has 0.25% to 1% of boardings; a small hub airport has at least 0.05%, but less than 0.25%; and a non-hub airport has more than 10,000 boardings, but less than 0.05%. There are 30 large hub, 38 medium hub, 68 small hub, and 385 non-hub airports.

**Marketing Collateral**—Materials that an airport or company use to identify their brand. Marketing collateral usually includes a logo, tagline, business card, and brochure.

**Nominal Dollars**—The actual amount of a dollar with no adjustment for inflation.

**Non-Aeronautical Revenue**—Non-aeronautical or landside revenue is generated from the following types of activities:

- Concessions—rents paid by gift shops, restaurants, and newsstands. Most concession contracts also require a concession to pay a percentage of its profits to the airport.
- Parking—fees for all airport-owned parking lots.
- Advertising—ads placed on airport walls, billboards, and buses as a source of airport income.
- Land rent—excess airport land rented for golf courses, office buildings, hotels, or farming.
- Permits—fees paid by off-airport companies to access the airport and pick up passengers (e.g., taxis or shuttle buses).

**Originating Passengers**—Passengers that begin the first leg of their trip.

**Per Turn**—One arrival and departure.

**Power Purchase Agreement**—Agreement between a power company and a host site for electric generation where the power company assumes the risks and responsibilities of ownership when it purchases, operates, and maintains a power generation facility. The host site in turn agrees to purchase energy or the capacity for a set amount of time and a specific price. This is a common way for airports to finance solar and wind power generation systems.

**Residual Cost Agreements**—A type of contract with an airport owner where airlines collectively agree to pay any costs of running the airport that are not allocated to other users or covered by non-airline revenue.

**Triple Net Lease**—A lease in which the lessee pays rent to the lessor as well as all taxes, insurance, and maintenance expenses that arise from the use of the property.

## ACRONYMS

AGSA	Aviation Ground Service Association
AIP	Airport Improvement Program
ALP	Airport Layout Plan
BAA	British Airports Authority
CATS	FAA Compliance Activity Tracking System
CBP	Customs and Border Protection
CDC	Centers for Disease Control
FBO	Fixed base operator
GAO	Government Accounting Office
LCC	Low-cost carrier
LCPA	Lee County Port Authority
MIC	Miami Intermodal Center
MRO	Maintenance, Repair and Overhaul
NAFTA	North American Free Trade Agreement
NPIAS	National Plan of Integrated Airport Systems
NREL	National Renewable Energy Laboratory
OAG	Official Airline Guide
OEM	Original Equipment Manufacturer
PPO	Preferred Provider Organization
SWOT	Strengths, weaknesses, opportunities, threats
TIF	Tax Increment Financing
WHO	World Health Organization

## APPENDIX A

### Airport Contacts

Business	Airport	Title/Department	Website
Advertising	Toronto Pearson International	General Manager of Concessions	www.gtaa.com
Biofuels	Air Transport Action Group		www.atag.org
Biofuels	National Energy Research Laboratory	Bioenergy	www.nrel.gov
Business Diversification	Centennial	Executive Director	www.centennialairport.com
Business Diversification	Denver International	Deputy Manager - Revenue & Business Development	www.flydenver.com
Business Diversification	Dallas-Ft. Worth International	Assistant VP, Commercial Development	www.dfairport.com
Business Diversification	Savannah/Hilton Head International	Direct of Administration & Finance	www.savannahairport.com
Business Plan	Dayton International Airport	Director of Aviation	www.flydayton.com
Geothermal	John F. Kennedy International		ww.panynj.gov
Ground Services	Bangor International	Ramp Services Manager	www.flybangor.com
Ground Services	Lehigh Valley International	Director	www.lvasfbo.org
Ground Services	Mobile Regional	Director of Aviation	www.mobairport.com
Ground Services	Quad City International	Director of Aviation	qcairport.com
Ground Services	Springfield-Branson National	Director of Aviation	www.sgf-branson-airport.com
Ground Services	Front Range	Director of Aviation	www.ftg-airport.com
Health Clinics	Atlanta-Hartsfield/Philadelphia/Charlotte		theaeroclinic.com
Health Clinics	Newark/JFK		harmonypharmacy.com
Health Clinics	Orlando International		www.solanticorlandourgentcare.com
Health Clinics	San Francisco		www.stmarysmedicalcenter.org
Intermodal	Miami Intermodal Center	Public Affairs Manager	www.micdot.com
Multi-Use	Pittsburgh International	Senior Director of Development	www.pitairport.com
Multi-Use	Edmonton International	Port Alberta Project Lead	corporate.flyeia.com
Multi-Use	Kansas City Intermodal Business Airpark	Manager of Air Cargo Development	www.flykci.com
Multi-Use	El Paso International	Director of Aviation	www.elpasointernationalairport.com
Oil and Gas	Greeley-Weld County	Airport Manager	www.gxy.net
Pet Kennel	Houston Intercontinental	Cargo Department	www.continental.com
Pet Kennel	Minneapolis-St. Paul		www.nowboardingpets.com
Pet Kennel	Various Locations		www.petparadiseresort.com
Pet Kennel	Indianapolis International		www.campbowwow.com
Redevelopment	Southwest Florida International	Senior Manager, Properties & Contracts	www.flylcpa.com
Redevelopment	Tampa International	Director of Properties & Contracts	www.tampaairport.com
Redevelopment	Oakland International	Oakland Airport South Properties	www.flyoakland.com
Redevelopment	Indianapolis International	Property Director	www.indianapolisairport.com
Solar	Fresno Yosemite International	Director of Aviation	www.fresno.gov
Wind Turbine	Boston Logan International	Director of Capital Programs/Environmental Affairs	www.massport.com
Wind Turbine	Greater Rochester International	Director of Aviation	www.monroecounty.gov/airport

Source: Assembled by KRAMER aerotek inc. (2009).

## APPENDIX B

### Examples of Non-Aeronautical Development

Airport	Code	State	Activity
Anchorage International	ANC	AK	Cold Storage
Atlanta Hartsfield International	ATL	GA	Health Clinic
Baltimore Washington International	BWI	MD	Bicycle Trail, Walking Paths
Bangor International	BGR	ME	Ground Services
Bob Hope Burbank	BUR	CA	TV and Movie Filming
Boston Logan International	BOS	MA	Wind Turbines, Walking Paths
Centennial	APA	CO	Golf Course, Sports Center, Motor Sports
Cheyenne	CYS	WY	Golf Course
Chicago O'Hare International	ORD	IL	Bicycle Trail
Colorado Springs Municipal	COS	CO	Joint Use Facility with Peterson A.F.B., Land Exchanges, Public/Private Development
Dallas-Ft. Worth	DFW	TX	Southgate Plaza, Mineral Extraction, Valet Parking, Golf Course
Dane County Regional	MSN	WI	Golf Course
Dayton International	DAY	OH	Strategic Business Plan, Highest & Best Use Study
Daytona Beach International	DAB	FL	Partnership with Integrated Airport Project
Denver International	DEN	CO	Westin Hotel, FasTracks Train, Agriculture, Renewable Energy, Bicycle Trail, Agriculture
Duluth International	DLH	MN	Maintenance Facility Reuse by Cirrus Aircraft
Edmonton International	YEG	AB	Port Alberta, Golf Course
El Paso International	ELP	TX	Butterfield Trail Golf Course, Air Cargo Complex, FTZ, Partnership with TXDOT for Access Road
Fort Lauderdale International	FLL	FL	Walking Paths
Fort Wayne International	FWA	IN	Golf Course
Fort Worth Alliance	AFW	TX	Public-Private Partnership (Development/Management)
Fresno Yosemite International	FAT	CA	Solar Installation
Front Range	FTG	CO	Ground Services, Wastewater Treatment, Biofuels
Gary/Chicago	GGY	IN	Alliance with Chicago O'Hare
George Bush Intercontinental	IAD	TX	Pet Kennel, Walking Paths
Greater Rochester International	ROC	NY	Wind Turbines and Solar Panels
Greeley-Weld County	GXY	CO	Mineral Extraction
Harrisburg International	MDT	PA	Multimodal Transportation Center
Hong Kong International	HKIA	China	Precious Metal Depository
Indianapolis International	IND	IN	Maintenance Center
John F. Kennedy International	JFK	NY	Geothermal, Terminal 5 Ground Handling, Pharmacy
Kansas City International	MCI	MO	Intermodal Business Centre
Kissimmee Gateway	ISM	FL	Special Events
Lehigh Valley International (Allentown)	ABE	PA	Ground Services
Miami International	MIA	FL	Intermodal Center, Common Use Passenger Clubs, Walking Paths
Mineta San Jose International	SJC	CA	Bicycle Trail, Walking Paths
Minneapolis-Saint Paul International	MSP	MN	Pet Kennel, Convenience Stores, Bicycle Trail, Walking Paths
Mobile Regional	MOB	AL	Airport Owned Ground Handling, Common Use Executive Club
Munich International Airport	MUC	Germany	Airport owned Ground Handling Subsidiary
Northwest Florida Regional	VPS	FL	Joint Use Facility with Eglin A.F.B
Oakland International	OAK	CA	Maintenance Facility, Solar, Golf Course, Bicycle Trail, Parking Revenue Incentives
Orlando International	MCO	FL	Cold Storage, Health Clinic, Walking Paths
Orly	ORY	France	Geothermal
Philadelphia International	PHL	PA	Health Clinic, Walking Paths
Phoenix Sky Harbor International	PHX	AZ	Convenience Store, Pharmacy, Golf Course
Pittsburgh International	PIT	PA	Midfield Terminal Air Mall, North Field Site Logistics Centre, Multimodal Corridor Study
Port Columbus International	CMH	OH	Golf Course
Quad City International	MLI	IL	Ground Services
Raleigh-Durham International	RDU	NC	Common Use Passenger Processing Equipment, Pharmacy
Rickenbacker International	LCK	OH	Cargo, Global Logistics Park & Intermodal Terminal
Ronald Reagan Washington National	DCA	DC	Bicycle Trail, Walking Paths
Salt Lake City International	SLC	UT	Golf Course, Bicycle Trail, Walking Paths
San Diego International	SAN	CA	Airport Multimodal Accessibility Plan
San Francisco International	SFO	CA	Mini Hotel, Medical Center

Airport	Code	State	Activity
Sarasota Bradenton International	SRQ	FL	Self Storage, Golf Course
Savannah Hilton Head International	SAV	GA	Golf Course, Mosquito Control Facility, Reservation Center, Logo Berms, Ground Handling, Office Space
South Bend Regional	SBN	IN	Multimodal Terminal
Southwest Florida International	RSW	FL	Skyplex Commercial Center, Walking Paths
Springfield-Branson National	SGF	MO	Ground Services
St. Cloud Regional	STC	MN	Land Acquisitions and Utility Extensions
Tampa International	TPA	FL	Maintenance Hangar Reuse
Toronto Pearson International	YYZ	ON	Common Use Lounges, Advertising Program
Van Nuys	VNY	CA	TV and Movie Filming
Wittman Regional (Oshkosh)	OSH	WI	Special Events

Source: Assembled by KRAMER aerotek, inc. (2009).

Abbreviations used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI-NA	Airports Council International-North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	Air Transport Association
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation